

Solid Waste Management in Class I Cities in India



Report of the Committee Constituted by
The Hon. Supreme Court of India

March '99

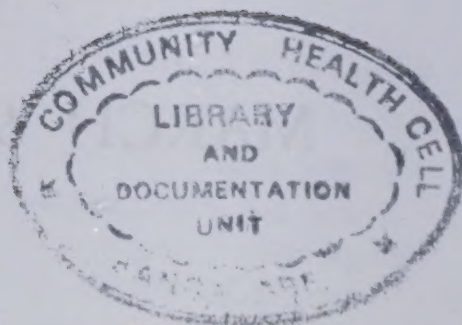
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CONTENTS

FOREWORD	1
PREFACE	2
EXECUTIVE SUMMARY	5
CHAPTER - 1 URBANISATION IN INDIA	
1.1 Urban growth	10
1.2 Municipal Management	10
1.3 Apathy towards SWM	10
CHAPTER - 2 PRESENT SCENARIO OF SWM	
2.1 Waste Generation	11
2. 1. 1 Waste generation rates	11
2. 1. 2 Total Waste generation	11
2. 2 Composition of Waste	11
2. 2. 1 Physical Characteristics of Waste	11
2. 2. 2 Chemical Characteristics of Waste	12
2. 3 Prevalent SWM Practices and Deficiencies	12
2. 3. 1 Storage of Waste at Source	12
2. 3. 2 Segregation of recyclable waste at Source	15
2. 3. 3 Primary collection of waste	16
2. 3. 4 Waste storage depots	16
2. 3. 5 Street sweeping	17
2. 3. 6 Timing & methodology of street sweeping	17
2. 3. 7 Tools used	18
2. 3. 8 Handcarts	18
2. 3. 9 Drawbacks	18
2. 3. 10 Transportation of waste	19
2. 3. 11 Drawbacks	20
2. 3. 12 Disposal of waste	20
2. 4 Institutional Deficiencies	21
2. 4. 1 Institutional Weakness	21
2. 4. 2 Division of responsibility	22
2. 5 Productivity of SWM Staff & Equipment	22
2. 5. 1 Manpower Productivity	22
2. 5. 2 Productivity of Equipment	22
2. 5. 3 Protective Equipment	23
2. 5. 4 Service to poor communities	23
2. 5. 5 Peri-urban areas	23

2. 6	Legal Aspects	23
2. 7	Financial Situation	24
2. 7. 1	Financial Discipline	24
2. 7. 2	SWM services neglected	24
2. 7. 3	Public - Private Partnership	24
2. 7. 4	Cost Recovery	24
2. 8	Lack of Community Involvement	24
2. 8. 1	Community apathy for improved SWM	24
2. 8. 2	Waste-pickers and informal recycling	25
CHAPTER - 3	RECOMMENDATIONS & TECHNICAL ASPECTS	
3. 1	Storage of Waste at Source	26
3. 1. 1	Households	26
3. 1. 2	Shops, Offices, Institutions & Workshops	28
3. 1. 3	Hotels & Restaurants	28
3. 1. 4	Vegetable & Fruit Markets	29
3. 1. 5	Meat and Fish Markets	29
3. 1. 6	Street Food Vendors	29
3. 1. 7	Marriage halls/ Kalyan Mandaps etc.	29
3. 1. 8	Hospitals, Nursing Homes, Laboratories etc.	29
3. 1. 9	Construction & Demolition Waste	30
3. 1. 10	Garden waste	31
3. 2	Segregation of Recyclable (Non-Biodegradable) Waste	31
3. 3	Primary Collection of Waste	32
3. 4	Modus Operandi	33
3. 4. 1	Door to door collection using containerised handcarts with bells/whistles	33
3. 4. 2	Role of the Sweeper	34
3. 4. 3	Collection through motorised vehicles	34
3. 4. 4	Collection of waste from societies/complexes	34
3. 4. 5	Collection of waste from slums	34
3. 4. 6	Door to door collection in upper class areas	34
3. 4. 7	Collection of duly segregated recyclable waste	34
3. 4. 8	Collection of waste from shops and establishments	35
3. 4. 9	Collection of bio-medical waste	36
3. 4. 10	Collection of Hotel / Restaurant waste	36
3. 4. 11	Collection of vegetable/fruit/meat and fish market waste	36
3.4.12	Collection of garden waste	36
3.4.13	Collection of waste from marriage halls etc	36
3.4.14	Collection of construction and demolition waste	37

3.4.15	Dairy and cattle shed waste	37
3. 5	Sweeping of Streets & Public Spaces	37
3. 5. 1	Street sweeping on a daily basis	37
3. 5. 2	All SWM services to be provided on sundays and public holidays	38
3.5.3	Substitution of sanitation workers	38
3.5.4	Prevent burning of waste by sweepers	38
3. 6	Tools to be Given to Sweepers	39
3. 6. 1	Brooms	39
3. 6. 2	Metal tray & Metal plate	39
3. 6. 3	Handcarts/ tricycles	39
3. 7	Norms of work for street sweepers	40
3. 7. 1	Working hours	40
3. 8	Cleaning of Surface Drains	41
3. 9	Removal of Silt from underground Drains/Manholes	41
3. 10	Provision of Litter Bins	41
3. 11	Temporary Waste Storage Depots	42
3. 12	Transportation Of Wastes	43
3. 12. 1	Domestic/ trade/ institutional wastes	44
3. 12. 2	Routing of vehicles	44
3. 12. 3	Use of vehicles in two shifts	44
3. 12. 4	Type of vehicles to be used	44
3. 12. 5	Bio-medical waste	45
3. 12. 6	Transportation of food waste from hotels & restaurants	46
3. 12. 7	Transportation of construction waste	46
3. 12. 8	Transportation of waste from narrow lanes	46
3. 13	Setting up of a transfer station	46
3. 14	Workshop facility for vehicle maintenance	46
3. 15	Processing & disposal of waste options available to local bodies	47
3. 15. 1	Composting	48
3. 15. 2	Sanitary Landfilling	48
3. 15. 3	Incineration	49
3. 15. 4	Power generation, fuel pellets, bio methanation	49
3. 15. 5	Choice of technology	49
3. 16	Recommended processing disposal options	49
3. 16. 1	Composting options	50
3. 16. 2	Microbial composting	50
3. 16. 3	Vermi-composting	50
3. 16. 4	Identification of land for processing & waste disposal	50

3. 16. 5	Site selection	51
3. 16. 6	Buffer Zone	52
3. 16. 7	Development of site	52
3. 16. 8	Landfill operation	53
3. 16. 9	Closure of landfill site	53
3. 16. 10	Handling and disposal of bio-medical waste	53
3. 16. 11	Disposal of Slaughter-house waste and carcasses of dead animals	54
3. 16. 12	Disposal of industrial Waste	54
3. 16. 13	Common treatment and disposal facilities	54
3. 16. 14	Closure of old disposal sites	54
3. 16. 15	"NIMBY" syndrome	54
3. 16. 16	Marketing mechanism for the sale of compost	55
3. 16. 17	Demonstration farming using compost	55
FLOW CHART OF MUNICIPAL SOLID WASTES		56
CHAPTER - 4 INSTITUTIONAL ASPECTS & CAPACITY BUILDING		
4. 1	Decentralisation of Administration	57
4. 2	Delegation of powers	58
4. 3	Induction of environmental/public health engineers	58
	Typical organisation chart for a city of 30 Lacs population	60
	Staffing and qualification norms for different sizes of cities	61
4. 4	Human resource development	62
4. 5	Work norms	62
4. 6	SWM Administration under one umbrella	63
4. 7	Safeguarding supervisory staff against abuse of the SC, ST (Prevention of atrocities) Act, 1989	63
4. 8	Tenure of the Municipal Commissioner & Chief Executive Officers	63
4. 9	Inter-departmental Co-ordination	64
4. 10	Encouragement to NGOs & Waste Collector Co-ops	64
4. 11	NGO/ Private Sector Participation	64
4. 12	Incentives to the Private Sector	65
4. 13	Amendment to Contract Labour (Regulation & Abolition) Act 1970	65
4. 14	Levy of Administrative Charges	65
4. 15	Mobile Sanitation Courts	65
4. 16	Role of technology/educational & research institutions	65
4. 17	Documentation of Best Practices	65
CHAPTER - 5 MANAGEMENT INFORMATION SYSTEMS		
	General information to be collected	66
	General information on SWM	67
	Monitoring of SWM services	68

CHAPTER - 6	FINANCIAL ASPECTS	72
6. 1	Financial discipline	72
6. 2	Review of financial position of ULB	73
6. 3	Assessment of Gap in finance	74
6. 4	Fiscal autonomy to local bodies	74
6. 5	Link obligatory services / Taxes / fees to the cost of living index	74
6. 6	Levy of charges on Central/State Govt. properties	74
6. 7	Tax-free status for Municipal bonds	74
6. 8	Property Tax reform	74
6. 9	Incentive to recycling industry	75
6. 10	Financial support of Govt. of India & State Govts.	75
6.11	Transfer savings of 10 th Finance Commission	77
6.12	Local bodies to avail of loans from HUDCO / Financial institutions like IREDA / LIC	77
6.13	Channelise SWM funds with Ministries	77
6.14	Allocation of larger funds to urban sector	77
6.15	Govt. of India Schemes to have SWM	77
6.16	Support to peri-urban areas	77
CHAPTER - 7	HEALTH ASPECTS	78
7. 1	Special attention to slums & traditionally dirty areas	78
7. 2	Implement low cost sanitation programme	79
7. 3	Temporary toilets at construction site	79
7. 4	Covering of buildings under construction	79
7. 5	Cattle nuisance	79
7. 6	Health monitoring for sanitation workers	79
7. 7	Prevent indiscriminate use of pesticides	79
7.8	Non Municipal authorities also to follow these instructions	79
CHAPTER - 8	LEGAL ASPECTS	80
8.1	Legal Provisions	80
CHAPTER - 9	PUBLIC AWARENESS	83
9.1	Reduce- Re-use – Recycle	83
9.2	Public participation	84
9.3	Public information, education, Communication & awareness programmes	84
CHAPTER - 10	CONSTITUTION OF A TECHNOLOGY MISSION	88
CHAPTER - 11	CLASSIFICATION OF RECOMMENDATIONS	90
11. 1	Mandatory recommendations for citizens	90
11. 2	Mandatory recommendations for local bodies	90
11.3	Discretionary recommendations for urban local bodies	91
CHAPTER - 12	SUGGESTIONS FOR THE CONSIDERATION OF CENTRAL & STATE GOVERNMENTS	92
CHAPTER - 13	TIME FRAME FOR IMPLEMENTATION	94

LIST OF ANNEXURES

A	Order of the Hon'ble Supreme Court of India	95
B	Bin : Population ratios in various Class I cities in India	97
C	Sweeper : Population ratio	98
D	(i) Types of wastes to be put in the bin meant for Food waste	99
	(ii) Types of recyclable wastes in separate bags	99
E	List of some domestic hazardous wastes	100
F	De-centralised composting	101
G	Aerobic microbial composting	102
H	Process of Vermicomposting	105

FOREWORD

The Hon'ble Supreme Court of India constituted a Committee for suggesting improvements in SWM practices in Class I cities in India. The Committee had detailed deliberations on the subject and interfaced with representatives of several States and ULBs (Urban Local Bodies) in the country through four regional workshops. I have great pleasure in submitting the final report incorporating the recommendations for improving SWM practices in Class I cities of the country and making cities clean and livable. I am happy to say that all the members of the Committee effectively participated in the deliberations. Many useful suggestions also emerged in the four regional workshops that were conducted by the Committee and these have been appropriately incorporated in the final report.

I would like to place on record the assistance provided by the Govt. of India, Ministry of Urban Affairs and Employment for the deliberations of the Committee and the State Governments of West Bengal, Tamilnadu, and Maharashtra for the smooth conduct of the regional workshops.

I would also like to put on record my deep appreciation for the dedicated and untiring efforts of Mr. P. U. Asnani, member of the Committee who has been instrumental in providing technical inputs as well as the framework for discussions and finalisation of the report. Mrs. Almitra H. Patel, member has also been a source of inspiration and information in facilitating the task of the Committee. Last but not least, the efficient and timely secretarial services provided by Mr. Sumit Chatterjee, Section Officer, Department of Urban Development have been commendable.

Sd/-
ASIM BARMAN
CHAIRMAN

PREFACE

Solid Waste Management (SWM) is one of the important obligatory functions of Urban Local Bodies in India. This service falls far short of desired levels, resulting in problems of health, sanitation and environmental degradation.

Given the pathetic situation of Solid Waste Management practices in the country and having no solution in sight, a public interest litigation was filed in the Hon'ble Supreme Court of India by Mrs. Almitra H Patel & another vs Union of India & others, seeking directions from the Hon'ble Supreme Court of India to the Urban Local bodies as well as the Government of India and the State Governments in the country, for improving Solid Waste Management practices expeditiously.

The Hon'ble Supreme Court of India entertained the Writ Petition No. 888 of 1996 and after several hearings felt it appropriate to constitute a Committee of the following members to look into all aspects of Solid Waste Management in the class I cities of India and submit a report to the Hon'ble Supreme Court of India.

- | | | |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| (1) | Mr. Asim Barman
Municipal Commissioner,
Calcutta Municipal Corporation | Chairman |
| (2) | Mr. S. R. Rao
Secretary, SSI, Govt. of Gujarat &
Ex-Municipal Commissioner, Surat. | Member |
| (3) | Mr. S. K. Chawla,
Chief Engineer, CPWD | Member |
| (4) | Mr. P.U.Asnani,
Urban Environment Infrastructure
Representative of India, USAID
& Consultant, Ahmedabad Municipal Corporation. | Member |
| (5) | Dr. Saroj
Joint Director,
Ministry of Environment & Forests | Member |
| (6) | Mr. Rajat Bhargava
Municipal Commissioner,
Vijayawada Municipal Corporation | Member |
| (7) | Mr. Yogendra Tripathi
Deputy Secretary,
Ministry of Urban Affairs and Employment. | Member
Secretary |
| (8) | Mrs. Almitra Patel
Convener, INTACH Waste Network. | Member |

The order of the Hon'ble Supreme Court regarding the constitution of the Committee and its terms of reference dated 16th January 1998 can be found in **Annexure 'A'**

Pursuant to the order of the Hon'ble Supreme Court of India dated 16-1-1998, the Ministry of Urban Affairs and Employment, Govt. of India issued Order No. Q-11021/1/97-PHE dated 29th January 1998 regarding the constitution of the SWM Committee.

This Committee comprises of practitioners in the field and representatives of relevant ministries besides the petitioner. The Committee had several sittings at Delhi, Calcutta, Ahmedabad and Bangalore where the Committee very carefully deliberated on the existing Solid Waste Management practices in Class I cities in the country and identified the deficiencies in the existing systems. The Committee after considering various aspects of Solid Waste Management and keeping in view the present status of the Urban Local Bodies in

India, their financial capabilities, technical know how, availability of technological options in India, the capacities of Indian industries to supply the machinery and equipment for modernising the systems etc. prepared an Interim Report dated 30th June, 1998 recommending actions to be taken by the urban local bodies and the support that may be extended by the Govt. of India and State Governments for improving Solid Waste Management practices in Class I cities in the country.

The Committee while submitting the Interim Report to the Hon'ble Supreme Court of India, had suggested to the Hon'ble Supreme Court that there was a need to conduct 4 workshops in various parts of the country to field test the recommendations before the Supreme Court gave any directions on the report. The Hon'ble Supreme Court had kindly agreed to this suggestion and directed the Committee to conduct 4 regional workshops at Delhi, Mumbai, Calcutta and Chennai and, after getting necessary feed back on the recommendations, submit its final report. The regional workshops were conducted

On	24 th October 1998	at	Calcutta
On	21 st November 1998	at	Chennai
On	28 th November 1998	at	Mumbai
On	15 th December 1998	at	New Delhi

The Mayors, Municipal Commissioners / Chief Executive Officers / Chief Officers, Heads of Departments of Solid Waste Management of various cities / corporations / municipalities, Secretaries to Government, Urban Development Department, Directors of Municipal Administration of various States, representatives of various national and international organisations, NGOs associated with SWM, representatives of Medical Practitioners' Associations, Traders' Associations, as well as those who are providers of service through the private sector, were invited to participate in the workshops.

Each workshop was conducted for a full day in which each recommendation was discussed, item by item, in detail, the feed-back of the participants was obtained and their views were heard. The views expressed by various participants were noted by the members of the Committee and have thereafter been carefully considered by the Committee. The participants were largely in agreement with the recommendations contained in the Interim Report.

The Committee after taking into consideration the views expressed by the members present in the 4 regional workshops and existing constraints of the local bodies, finalised its recommendations and submitted this report for appropriate consideration by the Hon'ble Supreme Court.

This Final Report is drafted in very simple language and made very brief so that even the smaller urban local bodies in the country can easily go through, understand and implement the recommendations without difficulty. Knowing the limitations of urban local bodies and their institutional capabilities, simple technologies and easily achievable standards with a liberal time frame have been suggested, so that the municipalities and the corporations could at least reach a minimum level of service in a period of 3 years. Thereafter these standards can be raised and made more and more stringent with the passage of time to reach higher levels of service. The Committee has also interacted with the Central Pollution Control Board in respect of laying down the minimum standards the local bodies should achieve.

In this report, the Committee has made recommendations for each stage of solid waste management services and has laid down the minimum level of service the local body must provide in a given time frame. While making the recommendations the Committee has also given various technological options which urban local bodies can consider and choose options most suited to their local conditions and financial capabilities.

The Committee has suggested amendments in State laws needed to make solid waste management practices effective and has also suggested to the Govt. of India to keep the SWM services outside the purview of the Contract Labour (Regulation & Abolition) Act 1970, so as to enable public-private partnerships and private sector participation in selected areas of Solid Waste Management for improving the quality of life in urban areas. This has often been recommended by the government itself. It has also been suggested that the supervisory staff of SWM services in the country be kept out of the purview of the Scheduled Caste, Scheduled Tribes (Prevention of Atrocities) Act 1989, to enable the supervisory staff to supervise the work of street sweepers and the labour force employed in collection, transportation, processing and disposal of waste fearlessly and effectively. The Committee has also made recommendations, which the State and

Central Governments may seriously consider, to improve the finances of urban local bodies and to give a boost to the composting of waste and recycling industry in this field.

The Committee strongly feels that due to the vastness of the country and lack of technical "know how" in the urban local bodies, a Technology Mission for solid waste management at the national level, may be set up by Govt. of India for a period of 5 years to effectively monitor, guide and support the implementation of these recommendations.

The Committee expresses its deep sense of gratitude to the Hon'ble Supreme Court of India, Ministry of Urban Affairs and Employment of Govt. of India for giving it an opportunity to look into one of the most important aspects of Urban Management and make recommendations which may eventually help in improving the Solid Waste Management Practices in urban areas resulting in environmental protection and improving the quality of life in the cities.

The Committee hopes that this report will meet with the expectations of the Hon'ble Supreme Court of India.

Sd/-
(Asim Barman)
Chairman

Sd/-
(S. R. Rao)
Member

Sd/-
(P. U. Asnani)
Member

Sd/-
(Rajat Bhargava)
Member

Sd/-
(S. K. Chawla)
Member

Sd/-
(Dr. Saroj)
Member

Sd/-
(Mrs. Almitra Patel)
Member

Sd/-
(Yogendra Tripathi)
Member Secretary

EXECUTIVE SUMMARY

Solid waste management is an obligatory function of Urban Local Bodies (ULBs) in India. However, this service is poorly performed, resulting in problems of health, sanitation and environmental degradation. With over 3.6% annual growth in urban population and the rapid pace of urbanisation, the situation is becoming more and more critical with the passage of time. Infrastructure development is not in a position to keep pace with population growth owing to the poor financial health of most of the urban local bodies. Solid waste management is one among the essential services which suffers the most in such a situation. Lack of financial resources, institutional weakness, improper choice of technology and public apathy towards solid waste management has made this service far from satisfactory.

PRESENT SCENARIO OF SOLID WASTE MANAGEMENT SERVICES.

Waste generation:

Waste generation ranges from 200 gms to 500 gms per capita per day in cities ranging from 1 lakh to over 50 lakhs population. The larger the city, the higher is the per-capita waste generation rate. The total waste generation of urban areas in the country is estimated to exceed 39 million tonnes by the year 2001.

Composition of Waste

Indian mixed waste has a large proportion of compostable material and inerts. As per NEERI studies, compostable matters range from 30% to 57% and inert materials from 40% to 54 %. The component of recyclable material is between 5% to 10%.

Technology adopted for storage, collection, transportation and disposal of waste:

The prevalent SWM practices in the country are highly deficient. Generally no storage of waste is being done at source and instead domestic, trade and institutional wastes including bio-medical and industrial waste, are thrown on the streets, footpaths, drains and water bodies treating them as receptacles of waste. Recyclable waste material is also not segregated at source and is disposed of on the streets, along with domestic, trade and other wastes. Construction and demolition wastes also pose a serious problem as these wastes are also deposited on the roadside or open spaces, obstructing traffic and causing nuisance.

Primary Collection

There is no system for the primary collection of waste in most Indian cities. The waste thrown on the streets is therefore, collected from the streets and/or from the street bins, which are inadequate in number and ill designed.

Waste Storage Depots

Open sites or cement concrete bins, metal bins, masonry bins and structures are used for temporary bulk storage of wastes. These bins are very unhygienic and necessitate multiple handling of waste. Moreover waste is more often seen outside the bins than inside them. These bins are also not cleared daily.

Street Sweeping

Street sweeping is not carried out regularly. Several streets are occasionally swept or are not swept at all. No sweeping is done on Sundays and public holidays in many cities. The tools used for street sweeping are also inefficient and out-dated.

Transportation of wastes

Transportation of waste is done through a variety of vehicles such as bullock carts, three-wheelers, tractors and trucks. Some cities use modern hydraulic vehicles. Most transport vehicles are loaded manually and utilised in one shift only, even though the number of transport vehicles is inadequate. The fleet of vehicles is thus not optimally utilised. Inefficient workshop facilities deplete the fleet of vehicles. The transportation system also does not synchronise with the system of primary collection and bulk waste storage facilities. Multiple manual handling of waste becomes necessary.

Processing and Disposal of Waste

Generally no processing of waste is done in the country except in a few cities where de-centralised or centralised composting is done on a limited scale. Disposal of waste is done in a most unscientific manner. Generally crude open dumping is adopted for disposal of waste in low-lying areas. Most local bodies deposit waste at the dump-yard without ascertaining the suitability of the land for waste disposal and do not bother to cover the waste with inert material. These sites emanate a foul smell and become breeding grounds for flies, rodents and pests and pose a serious threat to underground water resources. Thus, the entire system of waste management in the country is out-dated, unscientific and highly inefficient.

Institutional Arrangements

Institutional arrangements are inefficient. There is a lack of professionalism in administration in this service, resulting in poor levels of service. The laws governing the urban local bodies do not have adequate provisions to deal with the situation effectively and local bodies do not have the necessary power to punish defaulters. Filing cases in the court for sanitation offences have become cumbersome, takes a lot of time and energy, and does not give the desired results.

Community Involvement

There is total apathy on the part of citizens in the matter of handling their waste and in keeping the city clean. Citizens expect the local body to keep the city clean despite their non-involvement.

NGOs and the informal sector of rag pickers are not optimally utilised in tackling the ever-growing problems of waste management in urban areas.

65% of India's urban population lives in 300 Class I cities having a population above 100,000. These cities have been facing serious problems of solid waste management(SWM). The Committee has carefully considered various options to improve solid waste management practices in these cities. Given the present state of SWM practices in urban areas in the country, the institutional capabilities of local bodies, their financial health and other priorities, the Committee recommends a minimum level of services, as under, that each local body must provide and has given technological options in the detailed report which the local bodies may consider while choosing the technology suitable for their cities.

RECOMMENDATIONS FOR MODERNISATION OF SOLID WASTE MANAGEMENT PRACTICES IN CLASS I CITIES

Ban on Throwing of Wastes on the Streets

No waste shall be thrown on the streets, footpaths, open spaces, open drains or water bodies.

Storage of waste at source

Waste shall be stored at source of generation in 2 bins/bags, one for food / bio-degradable wastes and another for recyclable waste. Domestic hazardous waste, as and when produced, shall be kept separately from the above two streams.

Multistoreyed buildings (MSB's), commercial complexes and group housing shall additionally provide community bins for the storage of waste generated by their members. Community bins shall also be provided in slums by the local body for the community storage of waste by slum dwellers.

Doorstep Collection of Waste

Both the streams of waste, organic / biodegradable waste as well as recyclable waste, shall be collected from the doorstep. Containerised handcarts or containerised tricycles or small motorised vehicles shall be used for daily collection of food/ biodegradable waste from the doorstep through public participation using a bell, whistle or horn as a means of announcing the arrival of the collection staff.

For collection of recyclable waste from the doorstep, NGOs may be encouraged to organize the rag-pickers. They may allot them the work of collecting recyclable material from the doorsteps instead of picking it up

from the streets, bins or dump-yard, thereby upgrading their status. This waste can be collected once or twice a week according to the convenience of the households, shops or establishments.

Hazardous toxic waste material, which is occasionally generated, shall however be disposed of by the citizens in special bins to be provided in the city at suitable locations by the urban local bodies.

Sweeping of Streets on All Days of the Year

Sweeping of streets and other public places, having habitation or commercial activities on one or both sides, shall be done on all days of the year irrespective of Sundays and public holidays. Arrangements for rotating weekly rest-days are to be made by the local bodies.

Work Norms for Sweeping of Streets

Work norms ranging from 250 to 750 running meters of road length have been recommended, depending on the density of the area and local conditions. Giving a demarcated "pin point" area for street sweeping and waste collection is also recommended for optimum utilisation of manpower.

Provision of Litter bins at Public Places

Provision of litter bins at railway stations, bus stations, market places, parks, gardens and important commercial streets may be made, to prevent littering of streets.

Abolition of Open Waste Storage Sites and other Un-hygienic Street Bins

The pathetic condition of street bins must be corrected by the provision of neat mobile closed-body containers or vehicles into which waste can be directly transferred from the containerised hand carts or tricycles and all open waste-storage sites as well as cement concrete or masonry bins must be abolished in a phased manner.

Transportation of Waste to Synchronise with Waste Storage Facility - Dispense with Manual Loading of Waste

For the transportation of waste, a system, which synchronises with both primary collection and bulk waste storage facilities, may be introduced. Manual loading and multiple handling of waste may be dispensed with and instead, hydraulic vehicles for lifting the containers may be used in larger cities, and tractor trolleys or a tractor container combination may be used in smaller cities.

Transportation of waste shall be done on a regular basis before the temporary waste-storage containers start over-flowing. For economy in expenditure, the vehicle fleet should be used in at least two shifts. Workshop facilities may be optimised to keep at least 80% of the vehicle fleet on-road. Transfer stations may be set up in cities where the distance to waste-disposal sites is more than 10 kms.

PROCESSING AND DISPOSAL OF WASTE:

Conversion of Organic Waste / Bio-degradable Waste into Bio-organic Fertiliser (Compost)

With the availability of land for processing and disposal of waste becoming scarce and the food and bio-degradable component useful to agriculture going waste, measures for conservation of land and organic waste resources shall be taken and organics shall be returned to the soil. To meet these objectives, all food waste and biodegradable waste shall be composted, recyclable waste shall be passed on to the recycling industry and only rejects shall be landfilled in a scientific manner. Decentralised composting with public and NGO/CBO (non-Govt Organisation/Community-Based Organisation) participation may be encouraged wherever possible and centralised composting of the rest of the waste may be done. Microbial or vermi-composting processes may be adopted. A variety of composting options have been given in the report and their processes are explained.

Caution against using unproven technologies

Local bodies are cautioned not to adopt expensive technologies of power generation, fuel pelletisation, incineration etc. until they are proven under Indian conditions, and the Government of India or expert agencies nominated by the Government of India advises cities that such technology can be adopted.

Land to be made available on priority for processing and disposal of waste

Availability of land for setting up processing plants and for disposal of waste is a major problem faced by urban local bodies. Government wasteland must therefore be given on top priority for this purpose free or at nominal cost, and if such land is not available or is found not suitable, private land should be acquired or purchased through negotiated settlement. A Committee at the district level should identify suitable land and State Governments should form Empowered Committees to give speedy final clearance and prompt possession of suitable land to the ULB.

Criteria for Site Selection, Site Development and Landfill Operations

Criteria for site selection, development of land fill sites and scientific landfill operations may be adopted. Remediation of old abandoned landfill sites should also be done as suggested in the report. Bio-medical waste, industrial waste and slaughter-house waste may be managed as per the relevant Rules and guidelines of the Government of India and/or the Central Pollution Control Board.

Institutional Strengthening and Capacity Building

Institutional strengthening is the key to success of the SWM system. Professionalism in administration, decentralisation of administration, delegation of financial and administrative powers, induction of environmental / public health engineers in the solid waste management services, fixation of work norms and proper supervisory levels are recommended. Human resource development through training at various levels needs to be taken up. Municipal Commissioners and Chief Executives should not be transferred frequently and should have a tenure of at least 3 years to perform effectively. Inter-city meets for sharing of experience are recommended.

Adequate safe-guards for the supervisory staff against abuse of the Scheduled Caste/Scheduled Tribe (Prevention of Atrocities) Act 1984 may be provided through suitable amendments in the law to enable the Supervisory staff to perform their duties fearlessly.

NGO/Private sector Participation in SWM Services

There is a need to improve accountability and the level of services through NGO/Private sector participation in SWM services to improve overall performance without harming the interests of the existing staff. Suitable amendments to the Contract Labour (Regulation and Abolition) Act 1970 may be done by the Govt. of India to permit private sector participation in this service.

Enforcement

A system of levy of administrative charges or special cleaning charges from those who litter the streets or cause nuisance on the streets may be introduced and powers to punish offenders may be given to the local bodies through suitable additions to the Municipal acts & rules.

Management Information System(MIS)

MIS is the key to monitoring the performance of manpower and machinery and to help in planning for the future. Detailed management information systems suggested in the report may be introduced.

Financial Aspects

The poor financial health of ULBs is a major constraint in improving SWM systems. The financial condition of local bodies may first be improved by setting their house in order. A series of measures towards financial discipline, avoidance of wasteful expenditure, prioritising the expenditure on essential services, as recommended in the report, may be taken. Taxes, user charges and fees should be raised and linked to the cost-of-living index. Area-based property-tax reforms may be taken up to improve the finances of the ULBs.

Financial Support to ULBs by States and Central Governments

Financial support to ULBs from the State Government and the Central Government in terms of the 74th Amendment to the Constitution may be given expeditiously and funds may also be allocated to ULBs for a period of three years as per the formula given in the report. In the meantime, transfer of unspent grants by the 10th Finance Commission to the ULBs may be considered for modernising their SWM practices. Fiscal autonomy to local bodies, tax free status for municipal bonds, incentives to recycling and composting industries may be considered by the Central and State Governments and Union Territories.

Health Aspects

Improper SWM practices give rise to problems of health and sanitation. Twenty-two types of diseases are associated with improper SWM practices. Proper management of processing and disposal sites, special attention to cleaning of slums, provision of low cost sanitation facilities to prevent open defecation, prevention of cattle nuisance, proper training to the workforce and use of protective clothing are some of the measures the local body should take immediately to protect the health of the citizens and the work force.

Legal Aspects

Citizens' active participation may be ensured through massive public awareness campaigns. Simultaneously, adequate provisions may be made in State laws governing the local bodies, to ensure public participation and action against defaulters. Legislative provisions to be made by each State have been suggested in the report.

Public Awareness Strategy

Public awareness campaigns using Information, Education and Communication (I-E-C) techniques may be used. Waste Reduction, Reuse and Recycling (R-R-R) may be advocated to reduce the burden on the local body and citizens may be motivated to store waste at source in a two-bin system, co-operate with the doorstep primary collection system and keep the city litter-free. Hygienic Solid Waste Management needs to find a place in the National Agenda.

Technology Mission for Solid Waste Management

Given the vastness of the country and the present condition of urban local bodies, implementation of these recommendations requires very effective follow-up, monitoring and technical support. A Technology Mission for SWM may therefore be urgently constituted by the Government of India under the Ministry of Urban Development for a period of 5 years, having a mandate to monitor the performance of various local bodies, to guide the local bodies about various technologies for the processing and disposal of waste, to give technical assistance as well as financial assistance by channelising funds from various Government sources and/or financial institutions, to develop material for awareness programmes, to identify training needs, to bench-mark performance indicators and give continued and focussed attention to the reform of SWM practices nation-wide.

Time Frame

A time frame is necessary to implement the recommendations that have been prescribed, ranging from 3 months to 3 years as per the details given in the report.

CHAPTER – 1

URBANISATION IN INDIA

1.1 Urban Growth

217 Million out of 844 Million people of India live in urban areas. This accounts for 25.72% of the Indian population (1991 census). The process of Urbanisation is very rapid as compared to the growth of the Rural Population.

Whereas the decennial growth of the rural areas has been 19.71% during 1981-91, the urban population growth is as high as 36.19%. A net increase of 56.44 million people has been registered during the decade. With the current growth rate, by the turn of the century, the urban population of the country is likely to be 307 million (2001) which will be 30.5% of the total population and by 2011 it will be 395 million.

The number of urban areas is also increasing rapidly. In 1951, there were 3060 towns, in 1981 there were 4029 and as per 1991 census, this figure has gone upto 4689. Similarly the number of urban-agglomeration towns, which were 3378 in 1981, has gone up to 3768 in 1991.

It is interesting to note that as much as 65.20 % of the urban population is living in just 300 Class I Cities (1991 census).

1.2 Municipal Management

In urban areas the municipalities and municipal corporations, which are the local self-governments, manage the urban services. The municipal administration is generally responsible for providing basic amenities as per the provisions made in various legislations governing the local bodies in the States. The municipalities generally do not get much financial support from State or Central Govt. They are supposed to generate their own financial resources. However, the elected bodies do not muster the courage to levy, under their powers, taxes which may be commensurate with the level of services they wish to provide. Inadequate taxation and inefficient management both together render the municipal services far from satisfactory. The smaller municipalities have hardly any funds to meet their day-to-day requirements and have no capability to take measures for improving the level of service. Growing costs, shortage of funds, indiscipline among the work force, etc. is making the situation worse with the passage of time. In large cities, the situation is rather complicated and difficult. The infrastructural development is not in a position to keep pace with the population growth of such cities, resulting in serious inadequacies in services.

1.3 Apathy Towards Solid Waste Management (SWM)

The Management of Solid Waste is one of the essential services and it is an obligatory duty of municipal bodies to arrange for daily street cleaning and for the transport, processing and disposal of waste in urban areas. In spite of being responsible for provision of SWM services, the urban local bodies generally fail to make adequate provision for the primary collection, transportation and disposal of waste in an environmentally acceptable manner. In most urban areas, the management of urban wastes is looked at as an inferior function fit to be supervised only by the lower level of officers. The people at the helm of affairs do not consider SWM as a priority area though a very large percentage of funds of the urban local body is spent towards this most essential service. The apathy of decision-makers and urban planners is thus primarily responsible for the poor level of SWM services in urban areas.

CHAPTER - 2

PRESENT SCENARIO OF SOLID WASTE MANAGEMENT

2.1 WASTE GENERATION

2.1.1 Waste generation rates:

In Indian cities, the waste is generally not weighed. It is measured by volume to determine the quantity of waste disposed of.

Several studies conducted by NEERI and other consultants have shown that the waste generation rates are low in smaller towns whereas they are high in cities over 20 lakh population. The range is between 200 gms per capita per day and 500 gms per capita per day as shown in Table I below:

TABLE I Waste Generation per Capita

Population range (In lakhs)	Average per capita waste generation gms / capita / day
1 to 5	210
5 to 10	250
10 to 20	270
20 to 50	350
50 lakhs +	500

Source: NEERI Strategy Paper on SWM in India, Feb, 1996.

2.1.2 Total Waste generation:

It is estimated that the total waste generated by the 217 million people living in urban areas is 23.86 million tonnes / year (1991 position) and it may cross 39 million tonnes by 2001 AD.

2.2 COMPOSITION OF WASTE

2.2.1 Physical Characteristics of Waste:

In Indian waste, there is a small percentage of recyclable material and more of compostables and inert materials like ash and road dust. There is a very large informal sector of rag pickers, which collects recyclable waste from the streets, bins and disposal sites. They take away paper, plastic, metal, glass, rubber etc. for their livelihood, but a small quantity of recyclable material is still left behind. The physical characteristics of Indian waste are as under:

TABLE II

Physical Characteristics of Municipal Solid Waste in Indian Cities:

Population range (in millions)	No. of cities surveyed	Paper	Rubber, leather & synthetics	Glass	Metal	Total compostable matter	Inert material
0.1 to 0.5	12	2.91	0.78%	0.56	0.33	44.57	43.59
0.5 to 1.0	15	2.95	0.73	0.56	0.32	40.04	48.38
1.0 to 2.0	9	4.71	0.71	0.46	0.49	38.95	44.73
2.0 to 5.0	3	3.18	0.48	0.48	0.59	56.67	40.07
5.0 & above	4	6.43	0.28	0.94	0.80	30.84	53.90

- All values are in percent, and are calculated on wet weight basis.
- Source: NEERI Reports Strategy Paper on SWM in India, Aug.1995.

2.2.2 Chemical Characteristics of Waste:

Chemical analysis of Indian wastes has shown that total Nitrogen varies from 0.56% to 0.71%, Phosphorus from 0.52% to 0.82%, Potassium from 0.52% to 0.83% and the C/N ratio is between 21 and 31.

Calorific values have been found to range between 800 and 1010 K.cal/kg, and the density of waste between 330 and 560 kg/cu. m.

A study of Indian cities has shown the chemical composition of the solid waste as under

TABLE III

Chemical Characteristics of Municipal Solid Waste in Indian Cities

Population range (In millions)	Nitrogen as Total Nitrogen	Phosphorus as P_2O_5	Potassium as K_2O	C/N Ratio	Calorific Value Kcal/kg.
0.1 to 0.5	0.71	0.63	0.83	30.94	1009.89
0.5 to 1.0	0.66	0.56	0.69	21.13	900.61
1.0 to 2.0	0.64	0.82	0.72	23.68	980.05
2.0 to 5.0	0.56	0.69	0.78	22.45	907.18
5 and above	0.56	0.52	0.52	30.11	800.70

Source NEERI: Strategy Paper on SWM in India - Aug. '95.

2.3 PREVALENT SWM PRACTICES AND DEFICIENCIES:**2.3.1 Storage of Waste at Source:**

Storage at the source of waste generation is the first essential step towards appropriate waste management. This is substantially lacking in most of the urban areas.

(a) Domestic/ Trade/ Institutional Waste

Domestic waste consists of food waste and other discarded waste materials such as paper, plastic, glass, metal, rags and packaging materials.

Most households, shops, establishments and others often throw such waste on the street at random hours. Those who use nearby dustbins provided by the local body often throw the waste around the bin and not into it.

Most of the waste thus comes on the roads, streets, and lanes treating the public streets as receptacles of waste. This situation can be seen from the photographs shown below:



Photo 1 & 2: Solid Wastes deposited on the streets / open spaces in absence of system of storage of waste at source

Institutional buildings, offices, big hotels and others keep large bins for the storage of waste and quite often contract out the collection of recyclable waste deposited in these bins or hand over such waste to waste purchasers/waste pickers. The unwanted part of this waste also finds its way on to the streets.

(b) Construction and Demolition Waste

This waste is generated mainly by repair, maintenance and reconstruction activities. It contains bricks, cement concrete, stones, tiles, wood, etc.

The storage of this waste at the time of its generation and its disposal is totally neglected in the country. By and large, people deposit construction waste, after salvaging useful material, just outside their houses/shops/establishments or on to the streets or along major roads, creating nuisance and obstruction to traffic as can be seen from the photograph below.



Photo 3: Construction and demolition waste deposited on the roadside.

(c) Bio-medical waste :-

Bio-medical waste contains a variety of infectious and toxic wastes generated by hospitals, nursing homes, and health-care establishments. This waste causes an adverse impact on human health when it is not disposed of in a scientific manner.

This area of waste management is grossly neglected. A large number of hospitals, nursing homes, pathology labs and health care centers are situated in urban areas but these establishments do not take adequate measures for the safe disposal of their Bio-medical wastes. In most urban areas no facility exists for the safe disposal of such wastes, which get mixed with domestic solid waste and finally get deposited at domestic waste disposal dumpsites. Many large hospitals dispose of their mixed wastes within the hospital premises, where waste remains unattended in the open for a long time. Some hospitals and nursing homes have set up low-temperature incineration plants for the disposal of wastes, which quite often remain out of order as they are not managed and maintained properly. Infectious and non-infectious wastes are generally not segregated at source and instead the mixed (often wet) waste is taken to the incineration plant in a very unhygienic manner. The system of collection, transportation and disposal of Bio-medical waste is thus not scientifically designed.

Having realised the seriousness of the situation, the Govt. of India, Ministry of Environment has issued Bio-medical Waste (Management & Handling) Rules 1998. The situation of collection, transportation and disposal of Bio-medical waste is now likely to improve in future.

(d) Industrial Waste - Disposal Practices :

Many cities have small and big industries within the city limits and some cities have large industrial estates. These industries produce a lot of hazardous and non-hazardous industrial waste which is required to be disposed of by the industry following standards laid down by Pollution Control Boards at designated sites. In practice this does not happen. Most industrial solid waste is being disposed of in an unscientific manner surreptitiously on open plots or on the roadside or in water bodies in urban areas, creating environmental

pollution and sub-soil contamination as shown in the photograph below.



Photo 4: Industrial Hazardous Waste deposited in unauthorised open space

The principal reasons for the above situation are:

1. No suitable sites have yet been identified and Notified for the disposal of Industrial waste for most urban areas.
2. Treatment facilities are not adequately created by the industries individually or collectively.
3. Safe industrial waste disposal practices are not strictly enforced by State Pollution Control Boards and Pollution Control Committees.

In the absence of designated waste disposal facilities for the industries, the industries quite often do not know where to dispose of their industrial wastes. This is a compelling factor for indiscriminate disposal of industrial solid waste. Industries cannot be expected to hold on to their wastes on their premises indefinitely. Therefore, until State governments or local bodies provide adequate facilities or licensed sites for the disposal of industrial waste, industries are likely to continue to deposit their wastes unauthorisedly and pose a serious threat to the health and environment.

Thus it can be said that the existing facilities for storage of waste are highly inadequate and unsatisfactory.

2.3.2 Segregation of recyclable waste at Source:

In all parts of the country, people by and large do salvage re-usable or saleable material from waste and sell it for a price, e.g. newspaper, glass bottles, empty tins, plastic bags, old clothes etc., and to that extent such reusable / recyclable waste material is not thrown out for disposal. However, a lot of recyclable dry waste such as waste paper, plastic, broken glass, metal, packaging material etc., is not segregated and is thrown on the streets along with domestic / trade / institutional waste. Such waste is picked up to some extent by poor rag-pickers for their livelihood. At times they empty the dustbins and spread the contents around for effective sorting and collection. By throwing such recyclable material on the streets or into a common dustbin, the quality of recyclable material deteriorates as it gets soiled by wet waste, which often contains contaminated and hazardous waste.

Segregation of recyclable waste at source is thus not seriously practiced by households and establishments, who throw such waste on the streets or in the municipal bins unsegregated. At least 15% of the total waste can conveniently be segregated at source for recycling, which is being thrown on the streets in absence of the practice of segregation of waste at source. Part of this waste is picked up by rag-pickers in a soiled condition and sold to middle men at a low price, who in turn pass on the material to the recycling industry at a higher price and the waste that remains uncollected finds its way to the dumping grounds.



Photo 5: Rag-picker collecting recyclable waste from a street bin.

2.3.3 Primary collection of waste:

This is the most important component of SWM services and is grossly neglected. The systems adopted are primitive and inefficient.

There is no arrangement for house-to-house collection of waste, except in a few residential areas where private arrangements exist on payment basis. Community bins are also not available at convenient locations in urban areas for depositing domestic waste. Even in places where these have been provided, it has been observed that these are often unsuitably designed, inadequate in size and spaced too far apart.

Annexure B shows the inadequacy of dustbins.

The dust-bin : population ratio has large variations, ranging between 1:130 and 1:2389. The distance between the households and bins is also large, varying from 50 meters to 500 meters. As a result, quite a large number of people deposit waste on the streets, which is thereafter collected during street sweeping operations the next day.

In the absence of any system of primary collection of waste, street sweeping is the only method left for primary collection.

2.3.4 Waste Storage Depots

Local bodies have been placing dustbins/street bins for the temporary storage of waste collected by the sweeper as well as for the citizens to deposit their domestic waste. Besides the inadequacy of such bins, the bin design is found to be inappropriate and most unscientific. In many cities, open sites are identified as, or have become by usage, sites where waste is just dumped by the sweepers. In the cities where some bins are provided, by and large they are bottomless round precast - concrete bins or masonry bins constructed on the roadsides.

These bins necessitate double handling of waste. The sites where the bins are provided are not properly paved, giving rise to unhygienic conditions around the bin. This compels people to throw the waste from a distance, resulting in the waste gathering outside the bin, instead of inside the bin. Besides, the size of the bin is small, not enough to hold the waste brought to the site for temporary storage. This pathetic situation can be visualised from the following photographs.



Photo - 6 : Open waste storage site.



Photo -7 & 8 : Round bottomless cement-concrete bin & mesonry bin.

2.3.5 Street Sweeping

Street sweeping is the most common method of collection of all types of municipal waste as most of the waste is disposed of on the streets. Despite this, it is observed that all roads and streets are not being swept on a daily basis. In practice, certain important roads and markets are swept daily, some are swept on alternate days or twice a week, others are swept occasionally or not at all. The road length to be swept by a sweeper is not standardised nor has any scientific planning been done to direct which streets should be swept daily, on alternate days, twice a week, etc. depending on the concentration of population / activity on the roads and lanes. Adhocism prevails in this regard. There is no yardstick prescribed. At some places, sweepers are allotted work as per road-length, which varies from 100 meters to 5 km. At other places, it is on the basis of sq. meters, ranging from 3000 sq. meters. to 10000 sq. meters or on the basis of Sweeper: population ratio of one per 250 to 1000 population. The prevalent sweeper : population ratio is shown in **Annexure -'C'**.

2.3.6 Timing and Methodology of street cleaning:

Generally, street sweeping is done in two sessions during the day (morning and afternoon). Official duty hours range from 6 to 8 hours. In the morning, work is generally done between 6 am and 11 am and in the afternoon between 2 pm and 6 pm. These timings vary from city to city. In some cities continuous duty of 6 to 8 hours is also given. In the morning session, sweeping is generally carried out on roads, streets and lanes as per the work assigned to each sweeper. In the afternoons, group-sweeping work is generally done. At some places, individual sweeping areas are allotted in the afternoons also. Sweepers have to mark attendance two to four times a day at a muster point away from their sweeping beats, which takes a lot of their time. At some places, they have to walk more than 3 km to reach their place of work.

Sweepers sweep the streets with a short-handled or long-handled broom. While sweeping, initially they make small heaps of waste on the street and then load this waste into their hand-carts. In some cities the street sweeper is followed by another person who picks up the waste in the hand-cart / bullock cart/ tricycle. The waste is picked up in baskets with the help of a metal plate and deposited in a handcart, bullock cart or tricycle. In some cities a second sweeper follows on foot with a basket for picking up the heaps of waste made by the first street sweeper, and walks 50 to 100 meters to deposit this into a community waste storage bin on the street. Some examples of prevalent systems are shown below.

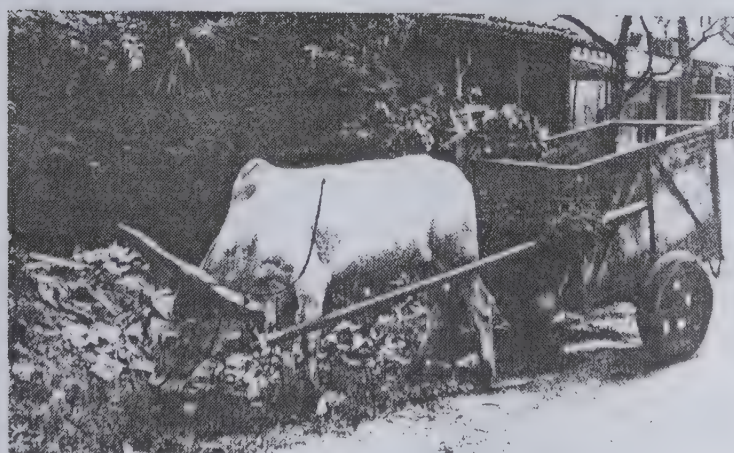


Photo- 9 & 10: Man driven and bullock driven handcarts utilised for primary collection of waste from the streets.

2.3.7 Tools used

Short-handled brooms are generally given to sweepers for street sweeping. They have to bend while sweeping, which causes fatigue and backache and reduces their output. The photograph below shows this inefficient method of street sweeping.



Photo - 11: Short handled broom utilised for street sweeping.

At some places long-handled brooms are also given to sweepers, which improves their productivity.

There is no uniformity in the number and quality of brooms given to sweepers. At some places they are given 3 brooms per month; at other places only one broom is given per quarter and at some places one bamboo and 1.5 kg bamboo sticks are given every six months. A bamboo broom cannot last for one year. Its life depends on the road length to be swept, type of road and the quality of broom used. Inadequate supply of tools to the sweepers reduces their efficiency.

2.3.8 Handcarts:-

A hand-cart is a very essential tool for a sweeper to carry street sweepings to the dustbin site. A variety of handcarts or wheelbarrows are in use. Some are very small and some are of medium size, but these handcarts are ill-designed as they have to be upturned for unloading the contents on to the ground. This creates insanitary conditions near the dustbin and necessitates multiple handling of waste. An example of such hand-carts is shown below:



Photo- 12: Traditional outdated hand-cart utilised for collection of street sweepings.

2.3.9 Drawbacks

The main drawbacks of the current street sweeping practices are:-

- 1) Though waste is produced and thrown on the streets every day, street sweeping is not carried out on Sundays and public holidays in many cities and towns.
- 2) All roads, streets and lanes are not covered in street sweeping operations.
- 3) There is a large variation in street sweeping norms, which vary from 1 : 100 meters/ sweeper/ day to 5 km/ sweeper/ day.
- 4) Sweeping in commercial areas begins in the morning around 6.30 am, but shops open after 9.00 am and start throwing their sweepings on the streets soon thereafter, nullifying the work just done by the sweepers.
- 5) Tools given to the sweepers are inadequate and inefficient.

- 6) Even after sweeping the streets, they do not look clean as the heaps of sweeping or drain silt made by one sweeper are not picked up by another set of staff on time and quite often the heaps are not removed for long, leaving a backlog of waste on the roads/streets.
- 7) Debris and construction waste spilling on roads.
- 8) Neglect of slum areas leads to insanitary conditions, water-borne and food-borne diseases and flooding due to clogging of drains by garbage and plastic bags thrown into storm-water drains.

2.3.10 Transportation of Waste:

Transportation of waste in the cities and towns is being done in various ways. In some cities, bullock carts, tractor-trailers, power tillers and tricycles are mainly used for the transportation of waste. These vehicles are used for the primary collection of waste from the streets and dust bins, as well as for the onward transport of waste either to a transfer station or to an open dumping site.

The principal reason for using bullock carts or tricycles is their easy availability and mobility in narrow lanes and the lack of financial resources to invest in and maintain modern vehicles and equipment.

In large cities hydraulic tipper-trucks, trucks, dumper placers, roll-on-roll-off machines, refuse collection machines and even compactors are used. Front-end-loaders are also used for loading waste into trucks.

However, even in big cities like Chennai, Madurai and Coimbatore in Tamil Nadu State, bullock carts are widely used even today for the primary collection and transportation of waste upto the transfer station. It is observed that these transport vehicles generally do not synchronise with bulk waste storage. Multiple handling of waste becomes necessary, making the entire operation unhygienic and expensive, as can be seen from the following photographs. In many cities, despite inadequate fleets and funds, vehicles are used in only one shift. Municipal trucks are thus grossly under-utilised. Often, the trucks or vehicles are not fully loaded by the workforce, resulting in loss of productivity of manpower and equipment.



Photo-13 & 14: Unhygienic system of transportation of waste from the waste storage depots.

2.3.11 Drawbacks:

- 1) The fleet of vehicles is not optimally utilised.
- 2) There is a wide variation in the output of vehicles ranging from bullock cart to lorries.
- 3) Waste handling is done manually. Loading and unloading being time consuming, it reduces the productivity of manpower and vehicles.
- 4) The transportation fleet deployment does not synchronise with the types and capacities of dustbins provided.
- 5) Double handling of waste becomes inevitably necessary.
- 6) The system is a potential health hazard for the workers because all types of waste, including hospital infectious waste and human excreta are disposed of in the common dustbin or on the streets.
- 7) Arrangement for separate collection of infectious biomedical waste is practically non-existent.
- 8) Dust bins are not cleared on a daily basis. Many bins are cleaned once or twice a week or even later. The backlog thus built up gives rise to insanitary conditions.
- 9) The number of vehicles is inadequate, and the percentage of vehicles remaining off the road is large, yet vehicles are often not used in 2 shifts.
- 10) Hydraulic vehicles need proper maintenance and well trained staff in the workshops, which is lacking.
- 11) Workshop facilities are not adequate.
- 12) Spare-parts procurement via frequent tenders is cumbersome and slow.
- 13) No monitoring of vehicle movement is done.
- 14) No monitoring of weight is carried out.

2.3.12 Disposal of Waste

Open crude dumping of waste in a most unscientific manner in low-lying areas is the commonest method used in the country for the disposal of waste. Some cities not having dumpsites even dump their waste haphazardly outside their city limits or along the sides of approach roads, creating heaps of waste on the roadside. A few local bodies also do composting of part of their waste.

(a) "Landfilling" practices.

By and large, crude dumping of waste is done in the country without following the principles of sanitary landfilling. As no segregation of waste at source takes place, all waste including hospital infectious waste generally finds its way to the disposal site. Quite often industrial hazardous waste is also deposited at dump sites meant for domestic waste.

The waste deposited at the dump site is generally neither spread nor compacted on a regular basis. It is also not covered with inert material. Thus, very unhygienic conditions prevail on the dump sites as could be seen from the photograph below.

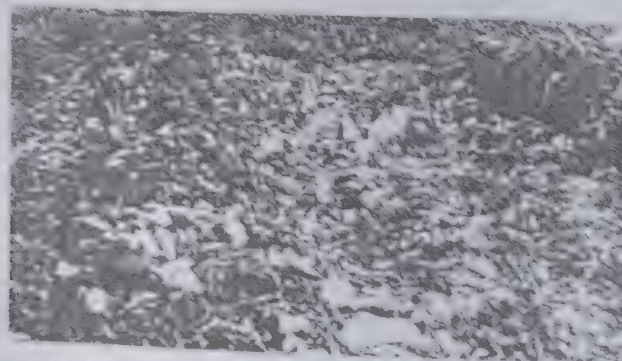


Photo -15: Crude dumping of Municipal Solid Waste at the landfill site.



Photo - 16: Disposal of waste on the sides of the road in absence of landfill site.

The deficiencies of the system are:

- 1) The principles of sanitary landfilling are not followed. Waste is just deposited in low-lying areas, quarry pits or roadsides without any testing for soil permeability or lining. Waste is neither compacted nor properly covered. It remains exposed and therefore causes nuisance, foul smell, smoke and environmental pollution of ground-water, air and soil.
- 2) Breeds flies, rodents and pests and also attracts dogs.
- 3) Dump sites endanger underground water resources as they cause subsoil water contamination.

(b) "Composting"

The composting of waste is presently being done at a few places departmentally in a most unscientific manner and at some places through private sector participation. Some local bodies just dump garbage into a pit or trench, partly cover it, keep it for six months and sell it out in "as is where is" condition at a throw-away price.

The entire operation is unhygienic, unscientific, foul-smelling and very slow. In some cities where microbial composting of waste or vermicomposting is being done with private sector participation, good results are seen.

2.4 INSTITUTIONAL DEFICIENCIES

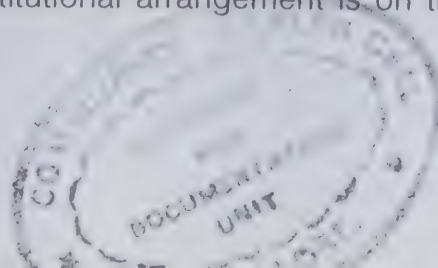
2.4.1 Institutional Weakness:

Under the laws that govern the administration of Urban Local Bodies in the country, it is made obligatory on the part of local bodies to arrange for street sweeping and disposal of solid waste.

However, as there is no system of accountability, this duty is not discharged efficiently. The institutional arrangement for SWM is extremely poor in most urban areas. Most of the city fathers and senior decision-making bureaucrats do not consider this subject worth their personal attention. In spite of this service consuming the largest Municipal budget, the subject is left in the hands of junior level supervisors having no vision, foresight or training. It is only in a few large cities where senior officers head the SWM Department or take personal interest, that the level of service is somewhat better.

It is observed that in small towns, very few supervisors are appointed to supervise the work of sanitation. At some places unqualified and untrained persons risen from the post of sweepers are appointed to supervise the work. The level of service in small towns is therefore very poor.

In most large towns and large cities, the Health Officers are put in charge of the SWM Department, In mega cities, Public Health Engineers/Civil Engineers are entrusted with this responsibility. In other cities generalists are also looking after the SWM service. The institutional arrangement is on the whole unsatisfactory.



2.4.2 Division of responsibility :

The role of the SWM Department is not well defined in most urban areas.

In most cities solid waste is removed by the health/SWM Department while the road section of the Engineering Department removes construction waste and debris and the drainage section of the Engineering Department looks after silt removal from underground drains. There is no synchronisation between these sections, with the result that the city generally looks dirty and one department blames another for the lapses. Besides, the workshop, which is the backbone of the SWM service, providing the fleet of vehicles and equipment required for city cleaning, is controlled by the Engineering Department, which does not appreciate the needs of the SWM Department. The maintenance of SWM vehicles gets low priority and generally old vehicles which need frequent maintenance are given to this Department. The transport staff also does not take orders from the SWM Department, which breeds insubordination and inefficiency in the service.

2.5 PRODUCTIVITY OF SWM STAFF & EQUIPMENT

2.5.1 Manpower Productivity

In the absence of scientific work-norms and effective monitoring systems, the productivity of labour and equipment is very low.

Sweepers, who are given small road lengths to sweep, complete their work in just one or two hours and then disappear from the site, whereas those who are given larger areas to care for, sweep just a small portion and leave the rest unattended. In the absence of scientific work-norms and effective monitoring systems, the productivity of labour and equipment is very low.

The main drawback is in work-distribution and lack of supervision. There are very few supervisors and many do not do their work sincerely for want of accountability, lack of support from higher authorities, fear of unions, etc.

Many lower-level supervisors do not often report for duty in time and quite often after marking the attendance of sweepers, many of them do not move effectively in the field for supervision and idle away their time in office. The sweepers, therefore, do not report for duty and do not start their work in time. After marking their attendance quite often they run away much before the close of duty hours to work privately elsewhere.

Senior Supervisors, such as various categories of Health Officers and Engineers, generally do not go to the field for supervising sanitation work or give this responsibility very little time, leaving the supervision in the hands of Sanitary Inspectors. They tend to go to office like any other administrative officer from 10.30 am to 6.00 pm giving the wrong signal to the field staff. In the absence of adequate supervision from senior level officers, the field staff, as well as junior level supervisors, take things easy and do not perform as expected of them.

On account of lack of supervision, motivation and large-scale absenteeism, the productivity of sweepers is generally below 50%.

2.5.2 Productivity of Equipment:

Equipment given to sweepers is generally outdated and inefficient. At most places, sweepers are given short handled-brooms and old-design, inefficient wheel-barrows.

Short handled brooms force the sweepers to bend while working. This causes fatigue and does not permit sweepers to work continuously for even 15 minutes. This necessitates intermittent rest and results in waste of time. The long-handled brooms are more efficient and enable the sweepers to work with ease for a long time without fatigue. But because of entrenched habits, acceptance of long-handled brooms is very poor.

Sweepers are either given baskets to collect the street sweepings or traditional wheel-barrows for the same. They find it inconvenient to fill waste into these baskets and wheel-barrows without supporting tools such as metal trays and plates. They have to make frequent trips to the dustbins carrying the waste in baskets. This

is time consuming and tiresome so they tend to throw the waste on the roadside or into open drains or burn it. The old design of the hand-carts makes it necessary to put the waste on the ground by turning the cart up side down. This causes nuisance and insanitary conditions.

Transport vehicle productivity is also very poor because of high down-time, inefficient deployment, inadequate loading of vehicles and absence of supervision and monitoring at the disposal-point, leading to "imaginary" trips.

2.5.3 Protective Equipment

Sweepers are generally not given protective equipment such as gloves, boots and masks though they are exposed to health risks on account of handling waste mixed with human excreta or hospital waste. The unfortunate experience is that, often where such equipment is given, sweepers do not use them and sell their safety equipment, including the uniforms.

2.5.4 Service to poor communities

The level of SWM service to poor communities is deplorable in all parts of the country and it does not reach the urban poor in small towns. In most urban areas the services have not been structured to cover urban slum encroachments, as the law does not cast a duty on local bodies to clean private lands. They are thus left to themselves. In large cities due to rapid industrialisation, slums are formed in various pockets. The slum population ranges from 20% to 50% of the city populations. These poor communities living in slums have highly inadequate basic amenities. The slum dwellers, on account of lack of living space, education, civic sense and viable alternatives, deposit their waste just outside their houses or in the close proximity of residential areas or into nearby storm-water drains from which the waste is rarely collected and decays, causing problems of sanitation, disease and environmental degradation. Most slums are served irregularly or not at all. In some cities they are cleaned occasionally by sending out special teams of sweepers to clean up the slums before the monsoon months as a preventive health measure.

A similar situation prevails in the Development Authority or Improvement Trust areas where drains and dustbins are provided but no infrastructure for servicing them, until they are included in Municipal limits after several years.

2.5.5 Peri-urban areas

Peri-urban areas adjacent to the cities suffer from neglect and lack of services as they are neither urban nor totally rural. These areas pose a threat to the health and environment of the cities.

2.6 LEGAL ASPECTS

Laws governing urban local bodies make it obligatory to ensure regular cleaning of their public streets and disposal of waste collected from these. In the absence of adequate legal provisions, citizens in general do not organise themselves for proper storage of waste at source, its community collection and disposal into the municipal system. In the absence of proper legislation, it is neither mandatory for the people to have a domestic bin, nor compulsory for urban local bodies to provide for community based collection, resulting in insanitary conditions in urban areas, which affect the environment adversely. The laws generally provide for street sweeping, provision of dust bins and removal of waste therefrom, which are inadequate to handle the situation effectively. They also do not give powers to local bodies to punish offenders. Local bodies have to file complaints in courts where the legal process is very slow for various reasons. The amount of fines that can be imposed is also very small. No impact is therefore created. People have no fear of such punishment. There is no provision to clean slum pockets, which are generally situated on private plots or on government or municipal lands. Insanitary conditions prevail in such areas and local bodies do not feel obliged to clean such areas.

2.7 FINANCIAL SITUATION.

2.7.1 Financial Discipline

Although local bodies have powers under the laws governing local bodies to levy certain taxes to raise their financial resources, they do not tap them adequately. Nor do they adequately assess or collect existing taxes. The political will to impose and collect adequate taxes from the people to meet the cost of services is lacking, resulting in steady deterioration of the services. The increase in cost of services is not correspondingly met by an increase in tax recovery. Besides, there is an element of large scale tax evasion and grave delays in assessing new buildings which is not curbed effectively.

2.7.2 SWM services neglected

The SWM service has remained extremely neglected in the country ever since independence. It never caught the attention of decision-makers. The service has thus remained primitive and inefficient. There is an urgent need for modernisation and mechanisation to improve the level of service and the quality of life of the people living in urban areas.

Improvement in SWM service necessitates initial investments to meet capital costs, followed by regular and timely provision of adequate funds for the maintenance of these services, which can be made up by reducing the establishment cost.

The financial scenario of urban areas shows that most local bodies experience an acute shortage of funds even to maintain existing services and are not in a position to undertake developmental activities and pay salaries in time.

2.7.3 Public - Private Partnership

Public indifference, increasing establishment cost of service and deteriorating standard of service rendered by the work force for various reasons, has compelled local bodies to think about introducing the element of public - private partnerships or private sector participation in the service.

Presently private sector participation is being attempted in getting vehicles on contract and at some places contracts are being given for collection and transportation of waste, which is working well. Recently many cities in the country have entered into contracts or memorandums of understanding with private companies for setting up compost plants with or without power generation. More and more cities plan to involve the private sector in various aspects of solid waste management. The provisions of the Contract Labour (Regulation and Abolition) Act 1970 do not permit contracting out of services which are currently being provided by the urban local bodies departmentally.

2.7.4 Cost Recovery

Cost recovery has not been attempted seriously in SWM services all these years. There is hardly any cost recovery. A small city-cleaning tax is imposed in some towns and cities, which does not meet a fragment of the cost incurred on SWM service. Rent-based low rateable value of the old properties does not generate adequate revenue and permit full cost recovery. There is a need for area-based Property Tax reform.

2.8 LACK OF COMMUNITY INVOLVEMENT

2.8.1 Community apathy for Improved SWM Service and Cost Sharing

People do desire a better quality of life and raise their voice quite often for improving Solid Waste Management Services, but when it comes to cost sharing, they shy away. Nor do they use the facilities already provided by the urban local bodies and keep on littering streets, regardless of income or education levels. It is a common experience that at places where the local body has made a provision of dust bins, people tend to throw the waste outside the bin instead of using the facility provided.

Though households and establishments spend a lot of money on their well-being, they do not show concern by sharing the costs for improved SWM services, despite knowing fully well that traditional services are poor and can be updated only by mobilising additional finances. However, of late some public responses are seen towards sharing of costs if people are assured a better quality of service. Studies at Panaji, Trivandrum, Cochin, Calicut, Delhi and Bangalore have shown that people are ready to share the costs if the level of service is improved. People have shown a willingness to pay from Rs.10 to 40 more per month for better SWM services.

2.8.2 Waste-Pickers and informal recycling and reuse

In India there is a large informal sector of rag-pickers who earn their livelihood from waste-picking from the streets, dust bins and waste dumps. It is estimated that these waste pickers pick up about 5% to 10% of the total waste produced in large urban areas and pass it on to the recycling industries through various levels of intermediaries. These rag-pickers thus reduce the burden of local bodies by several million rupees a year in collection, transport and disposal costs, as well as resultant saving of landfill space. This will also give value addition to recyclable waste and help in conserving national resources but their role has not been recognised and acknowledged by the society or the authorities. Hundreds and thousands of rag pickers start picking up waste in the early hours from 4 am and carry on this work throughout the day. Despite this voluntary service which benefits both citizens and municipalities, waste-pickers are regularly driven out by the Police and viewed with distaste and suspicion by the public at large and even some Courts. A large number of waste purchasers buy this recyclable material from them at a very low cost and pass on the material to industry at a good profit. In spite of this, the waste pickers earn something between Rs.15 and Rs.50 per day. They generally pick up papers, plastics, metal, glass, rags, etc. Besides the waste-pickers, there are several waste purchasers who move from house to house for buying reusable materials. A very large network exists in the informal sector for the re-use and recycling of waste. An effort to organise the waste pickers is a difficult task as the people involved in purchasing recyclable material work against the interests of the waste pickers. Therefore, quite often, efforts made to organise rag-pickers are sabotaged by such vested interests. However, examples at Ahmedabad, Rajkot, Mumbai, Chennai, Bangalore etc., show that waste-pickers can be organised and can get better quality waste from the door-step to give them a better living and much higher dignity of work as waste-collectors.

CHAPTER 3

RECOMMENDATIONS FOR THE MODERNIZATION OF SOLID WASTE MANAGEMENT PRACTICES IN CLASS I CITIES IN INDIA

TECHNICAL ASPECTS

3.1 STORAGE OF WASTE AT SOURCE

It is essential to keep the streets and public places clean at all times of the day. This is possible only if waste producers co-operate and effectively participate in the waste management efforts of the local body. If people keep on throwing waste on the streets indiscriminately, the local body cannot keep the city clean in spite of its best efforts. People, therefore, have to form a habit of storing the waste at source in their personal bin/bins and discharge the waste into the municipal system only, at specified times.

MANDATORY RECOMMENDATION

NO WASTE SHALL BE THROWN ON THE STREETS, FOOTPATHS, OPEN SPACES, DRAINS OR WATER BODIES.

WASTE SHALL BE STORED AT THE SOURCE OF WASTE GENERATION IN TWO BINS/BAGS, ONE FOR FOOD WASTE / BIO-DEGRADABLE WASTE AND ANOTHER FOR RECYCLABLE WASTE SUCH AS PAPERS, PLASTIC, METAL, GLASS, RAGS ETC. (See Annexure D)

WASTE SUCH AS USED BATTERIES, CONTAINERS FOR CHEMICALS AND PESTICIDES, DISCARDED MEDICINES AND OTHER TOXIC OR HAZARDOUS HOUSEHOLD WASTE (See Annexure E), IF AND WHEN PRODUCED, SHOULD BE KEPT SEPARATELY FROM THE ABOVE TWO STREAMS OF WASTE.

The following measures may be taken by urban local bodies to meet the above expectations.

3.1.1 Households

All households may be directed that:-

1. They shall not throw any solid waste in their neighbourhood, on the street, open spaces, vacant plots or into drains.
2. They shall (a) keep the food waste/bio-degradable waste as and when generated, in any type of domestic waste container, preferably with a cover, and (b) keep dry / recyclable waste preferably in bags or sacks as shown below :-



Photo - 17 : Domestic bin used for the storage of food / bio-degradable waste.



Photo - 18 : Nylon bag utilised for storage of recyclable waste at the household level through NGO effort.

3. Use of a metal or plastic container with a lid is advised for the storage of food/bio-degradable waste/wet waste. A container of 15 litre capacity for a family of 5 members would ordinarily be adequate. However, a household may keep larger containers or more than one container to store the waste produced in 24 hours having a spare capacity of 100% to meet unforeseen delay in clearance or unforeseen extra loads. Wet waste should preferably not be disposed of in plastic carry bags.
4. Keep domestic hazardous waste (listed in Annexure E) separately, for disposal as arranged for by the ULB.
5. A private society, association of flats/multistoried buildings etc. shall provide a community bin facility for the members of their society/association for the storage of wet domestic waste and instruct all residents to deposit their domestic waste in these community bins, to facilitate collection of such waste by the local body from the designated spot.
6. In case of Multi Storied Buildings (MSBs) where it may be difficult for the waste collector to collect recyclable waste from the door step, the association of MSBs may optionally keep one more community bin for the storage of recyclable material.
7. In slums, where because of lack of access or narrow lanes it is not found convenient to introduce a house-to-house collection system, community bins of suitable sizes ranging from 40 to 100 litre capacity shall be placed at suitable locations by the local body to facilitate the storage of waste generated by them. They may be directed to put their waste into the community bins before the hour of clearance each day as shown below.



Photo - 19 : Community bin placed in a slum pocket for community level storage of domestic waste.

8. In a situation where the local body finds it difficult to place smaller community bins in the slums on account of lack of awareness among the slum dwellers, the local body may provide larger containers which may match with the local body's transportation system at locations which may be suitable to the slum dwellers and convenient for the local body to collect such waste. The slum dwellers may be directed to deposit the waste in such larger bins before the hour of clearance of waste each day.

3.1.2 Shops/ Offices/ Institutions/ Workshops etc.:

All shops and establishments may be directed that:-

1. Shops, Offices and Institutions shall refrain from throwing their solid waste /sweeping etc. on the footpaths, streets and open spaces.
2. They shall keep their waste on-site as and when generated in a suitable container until the time of doorstep collection.
3. The size of the container should be adequate to hold the waste they normally generate in 24 hours with 100% spare capacity to meet unforeseen delay in clearance or unanticipated extra loads.
4. They shall keep hazardous waste listed in Annexure E separately as and when produced and dispose of it as per directions given by the local ULB.
5. The association of private commercial complexes/ multi-storied buildings (MSBs) shall provide suitable liftable community bins that match with the waste collection and transportation system of the local body for the storage of waste by their members and direct them to transfer their waste into the community bin before the prescribed time on a daily basis.

The association should consult the local body in this matter in advance and finalise the type of bin and the location where such community bins shall be placed to facilitate easy collection of such waste.

The following photograph illustrates the use of such bins.

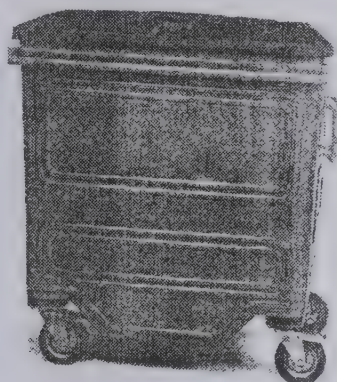


Photo - 20 : One among a variety of bins that could be used for community storage of waste in multi-storey buildings / commercial complexes.

3.1.3 HOTELS AND RESTAURANTS :-

All hotels and restaurants may be directed that :-

Hotels and restaurants shall refrain from throwing their dry and wet solid waste / sweepings on the footpath, streets, open spaces or drains.

1. They shall also refrain from disposal of their waste into municipal street bins or containers.
2. They shall store their waste on-site in sturdy containers of not more than 100 Litre capacity. The container should have an appropriate handle or handles on the top or side, and a rim at the bottom, for ease of emptying.

In the case of large hotels and restaurants where it may not be convenient to store waste in 100 litre or smaller sized containers, they may keep larger containers which match with the primary collection and transportation system that may be introduced in the city by the urban local body, to avoid double handling of waste.

3. They shall keep hazardous waste (listed in Annexure E) separately as and when produced and dispose it of as per the directions.

3.1.4 Vegetable/Fruit Markets

These markets produce large volumes of solid waste.

The local body may either:-

- a) direct the association of the market to provide large size containers which match with the transportation system of the local body or
- b) depending on the size of the market, the local body may provide large size containers with lids or skips as illustrated below for the storage of market waste at suitable locations within the market on full cost/partial cost recovery as deemed appropriate.

The shopkeepers may be directed that they shall not dispose of waste in front of their shops / establishments or anywhere on the street or in open spaces and instead shall deposit their waste as and when generated into the large size container that may be provided for the storage of waste in the market.

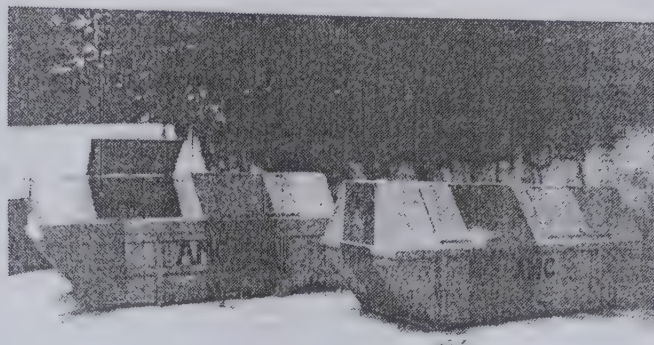


Photo - 21 : Large containers placed in Vegetable/Fruit markets on a paved floor for the storage of market waste.

3.1.5 Meat and Fish Markets

1. The shopkeepers shall not throw any waste in front of their shops or anywhere on the streets or open spaces.
2. They shall keep within their premises sturdy containers (of size not exceeding 100 liters) having a lid, handle on the top or on the side and a rim at the bottom of the container, with adequate spare capacity to handle unforeseen loads.

3.1.6 Street Food Vendors

All street food vendors may be directed not to throw any waste on the street or pavement. They must keep bins or bags for the storage of waste that they generate during their activity. Their handcarts must have a shelf or canvas below for the storage of waste generated in the course of business.

3.1.7 Marriage halls/Kalyan Mandaps/Community halls etc.

A lot of waste is generated when marriages or social functions are performed at these places and unhygienic conditions are created. Suitable containers with lids which may match with the primary collection or transportation system of the local body should be provided by these establishments at their cost and the site of their placement should be finalised in consultation with the urban local body to facilitate easy collection of waste. On-site bio-digesters for food waste should be encouraged.

3.1.8 Hospitals/Nursing Homes/Pathological laboratories/Health care centers/Establishments etc.

These establishments produce bio-medical as well as ordinary waste.

1. These establishments may be directed that they shall refrain from throwing any bio-medical waste on the streets or open spaces, as well as into the municipal dust bins or the domestic waste collection sites.

2. They shall also refrain from throwing any ordinary solid waste on footpaths, streets or open spaces.
3. They shall keep colour-coded bins or bags as per the directions of the Government of India, Ministry of Environment, Bio-medical Waste (Management & Handling) Rules 1998, and follow the directions of CPCB & State PCBs from time to time for the storage of biomedical waste including amputated limbs, tissues, soiled bandages, used injections, syringes, etc. Another container with a lid for the storage of food waste and other waste fit to be disposed of into the municipal domestic waste stream shall also be provided by them.

The storage of bio-medical waste shall be done strictly in conformity with directions contained in the Government of India's aforesaid notification.

3.1.9 Construction & Demolition Waste

1. No person shall dispose of construction waste or debris on the streets, public spaces, footpaths or pavements.
2. Construction waste shall be stored until removed, only within the premises of the building, or in containers where facilities of renting-out containers are available. In exceptional cases where storage of construction waste within the premises is not possible, the waste producer shall take prior permission of the local authority or the State Government as may be applicable for temporary storage of such waste, and having obtained and paid for such permission, may store such waste in such a way that it does not hamper the traffic, the waste does not get spread on the road and does not block the surface drain or storm water drain.
3. Local bodies above 10 lakh population may endeavour to provide or encourage the facility of skips/containers on rent for the storage and transportation of construction waste as illustrated below.

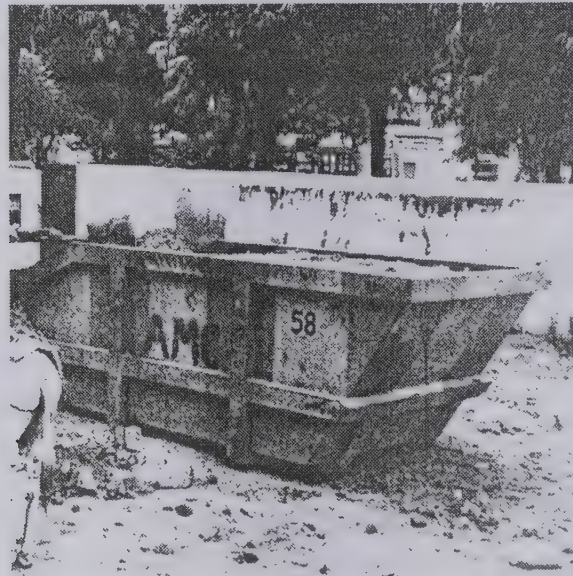


Photo - 22 : Open skip (container) kept for the storage of construction / demolition waste.



Photo - 23 : Transportation of construction waste.

3.1.10 Garden waste :

Private gardens should as far as possible compost and re-use all plant waste on-site. Where it is not possible to dispose of garden waste within the premises and the waste is required to be disposed of outside the premises, it shall be stored in large bags or bins on-site and transferred into a municipal system on a weekly basis on payment. The generation of such waste should as far as practicable be regulated in such a way that it is generated only a day prior to the date of collection of such waste and should be stored in the premises and kept ready for handing over to the municipal authorities or the agency that may be assigned the work of collection of such waste.

Large public parks and gardens should endeavour to compost and utilise all the garden waste and fallen leaves from avenue trees, within the garden. However, if such waste has to be disposed of, they may keep large skips, which match with the municipal transportation system for transportation of such waste. Such skips may be provided by the local body or the Government owning such parks and gardens. In case of private parks and gardens, they should make their own storage arrangement which matches with the municipal primary collection and transportation system.

3.2 SEGREGATION OF RECYCLABLE WASTE

It is essential to save the recyclable waste material from going to the waste processing and disposal sites and using up landfill space. Profitable use of such material could be made by salvaging it at source for recycling. This will save national resources and also save the cost and efforts to dispose of such waste. This can be done by forming a habit of keeping recyclable waste material separate from food waste, in a separate bag or bin at the source of waste generation, by having a two-bin system for storage of waste at homes, shops and establishments where the domestic food waste (cooked and uncooked) goes into the Municipal system and recyclable waste can be handed over to the waste collectors (rag-pickers) at the door step.

MANDATORY RECOMMENDATION

THE LOCAL BODIES SHALL DIRECT HOUSEHOLDS, SHOPS AND ESTABLISHMENTS NOT TO MIX RECYCLABLE WASTE WITH DOMESTIC FOOD/ BIO-DEGRADABLE WASTE AND INSTEAD KEEP RECYCLABLE / NON-BIODEGRADABLE WASTE IN A SEPARATE BIN OR BAG AT THE SOURCE OF WASTE GENERATION.

The following measures may be taken by the local bodies towards the segregation of recyclable waste:

The local body may mobilise NGOs or co-operatives to take up the work of organising street rag-pickers and convert them to door-step “waste collectors” by motivating them to stop picking up soiled and contaminated solid waste from the streets, bins or disposal sites and instead improve their lot by collecting recyclable clean material from the doorstep at regular intervals of time. The local bodies may, considering the important role of rag pickers in reducing the waste and the cost to the local body in transportation of such waste, even consider extending financial help to NGOs and co-operatives in providing some tools and equipment to the rag pickers for efficient performance of their work in the informal sector.

The Local Bodies may actively associate resident associations, trade & industry associations, CBOs and NGOs in creating awareness among the people to segregate recyclable material at source and hand it over to a designated waste collector identified by the NGO. The local body may give priority to the source segregation of recyclable waste by shops and establishments and later concentrate on segregation at the household level.

The upgraded rag-pickers on becoming door-step waste-collectors, may be given an identity card by the NGOs organising them so that they may have acceptability in society. The local body may notify such an arrangement made by the NGOs and advise the people to cooperate.

This arrangement could be made on “no payment on either side basis” or people may negotiate payment to such waste collectors for the door-step service provided to sustain their efforts.

3.3 PRIMARY COLLECTION OF WASTE

It is necessary to provide a daily service to all households, shops and establishments for the collection of putrescible organic waste / food waste / bio-degradable waste from the doorstep because of the hot climatic conditions in the country. This service must be regular and reliable. Recyclable material can be collected at longer regular intervals as may be convenient to the waste producer and the waste collector, as this waste does not normally decay and need not be collected daily. Domestic hazardous waste is produced occasionally and so such waste need not be collected from the doorstep. People could be advised or directed to put such waste in special bins kept in the city for the disposal of such waste.

MANDATORY RECOMMENDATIONS:

DOMESTIC, TRADE AND INSTITUTIONAL FOOD/ BIO-DEGRADABLE WASTE, SHALL BE COLLECTED FROM THE DOORSTEP OR FROM THE COMMUNITY BIN ON A DAILY BASIS.

RECYCLABLE WASTE MATERIAL/NON BIO-DEGRADABLE WASTE OTHER THAN TOXIC AND HAZARDOUS WASTE SHALL BE COLLECTED FROM THE SOURCE OF WASTE GENERATION AT THE FREQUENCY AND IN THE MANNER, NOTIFIED BY THE LOCAL BODY FROM TIME TO TIME.

DOMESTIC HAZARDOUS/ TOXIC WASTE MATERIAL SHOWN IN ANNEXURE 'E' SHALL BE DEPOSITED BY THE WASTE PRODUCERS IN SPECIAL BINS THAT MAY BE PROVIDED BY THE LOCAL BODY AT VARIOUS PLACES IN THE CITY FOR DEPOSITING SUCH WASTE.

The following arrangements shall therefore be made by the local bodies:-

Local bodies shall arrange for the primary collection of waste stored at various sources of waste generation by any of the following methods or a combination of more than one method:

1. Doorstep collection of waste through containerised handcarts/tricycles or other similar means with active community participation as shown in the photograph below :-

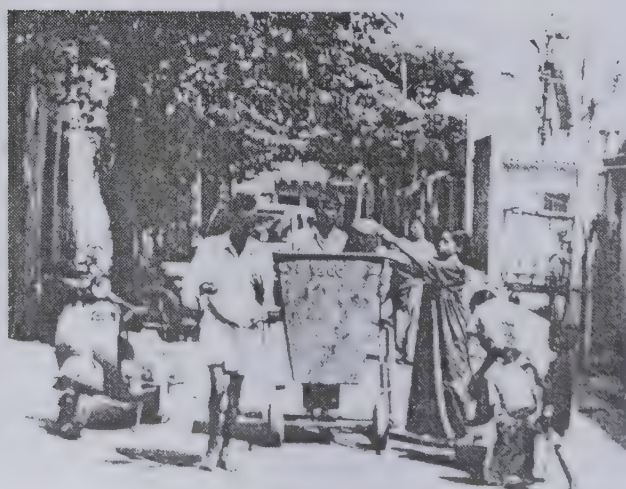


Photo - 24 & 25 : Doorstep collection of waste through containerised hand-cart with public participation.

2. Doorstep collection of waste through motorised vehicles having non-conventional horns deployed for doorstep waste collection with active community participation.
3. Collection through community bins from private societies, multi-storied buildings and commercial complexes.
4. Doorstep or lane-wise collection of waste from authorised and unauthorised slums, or collection from the community bins to be provided in the slums by the local bodies.
5. House-to-house collection of waste from posh residential areas where community participation is not likely, on full-cost-recovery basis as illustrated below :-

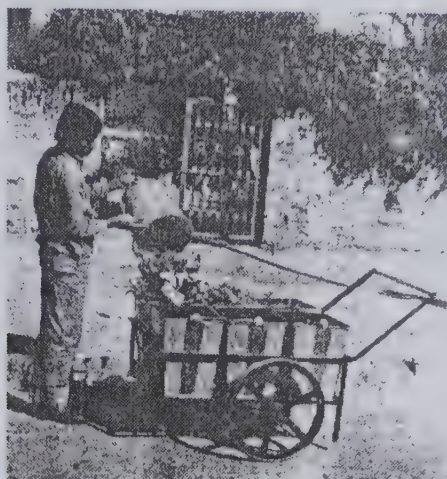


Photo - 26 : Special services of house to house collection of waste from posh residential and commercial areas on cost recovery basis



Photo – 27 : House to house collection of food /bio-degradable waste as well as recyclable waste in a private society on a monthly payment basis through an NGO effort.

6. The local body should provide special bins for the disposal of domestic hazardous waste listed in Annexure E at various places in the city and notify the location to the people. These should be covered bins of a distinct colour so that they can be identified easily.

3.4 MODUS OPERANDI

3.4.1 Door-step collection through containerised handcarts with bells/whistles

Each sweeper may be given a hand-cart having detachable containers (preferably 4-6) of 30 to 40 litre capacity each. A bell may be affixed to the hand-cart or a whistle may be provided to the sweeper in lieu of a bell. Each sweeper shall be given a fixed area or beat for sweeping plus a fixed number or stretch of houses for the collection of waste. The local bodies may, based on local conditions, fix the work norms as they deem appropriate. It is suggested that in congested or thickly populated areas, 300 running meters of road length and the adjoining houses may be given to each sweeper, whereas in less congested areas 500 running meters of the road length with adjoining houses may be allotted to a sweeper depending upon the density of population in the given area and local conditions. In low density areas even 750 running meters of road length and houses can be given. Normally 150 to 250 houses coupled with the above road length may be taken as a yardstick for allotment of work to an individual sweeper.

3.4.2 Role of the sweeper

The sweeper should ring the bell or blow the whistle announcing his/her arrival at the place of work and start sweeping the street. The people may be directed that on hearing the bell or whistle they should put their domestic/bio-degradable waste into the hand-carts of the sweeper or hand over the waste to him/her.

At places where it is not convenient for the householder to deposit the waste in the handcart / tricycle, on account of their non-availability at home when the sweeper arrives in their area, they may leave the domestic waste in domestic bins or bags just outside their house on the street in the morning so as to enable the sweeper to pick up the waste and put it into the handcart.

No sweeper may be expected or directed to do house-to-house collection by asking for waste at the door, as this will affect his energy and productivity.

3.4.3. Collection through motorised vehicles

Local bodies, as an alternative to door-step collection through containerised handcarts, may deploy motorised vehicles having an unconventional horn for the door-step collection of waste. The driver of the vehicle should intermittently blow the horn announcing his arrival in different residential localities and on hearing this, the householders should deposit their domestic waste directly into such vehicle without loss of time.

3.4.4 Primary Collection of waste from Societies/Complexes

In private societies, complexes and multistoried buildings, normally no sweepers are provided by local bodies, hence private sweepers are generally engaged. It may be therefore made compulsory for the management of the societies, complexes and MSBs to keep community bins or containers in which dry and wet waste may be separately stored by the members. Such bins may be placed at an easily approachable location to facilitate easy collection by the municipal staff or the contractors engaged by the local body. The local body should arrange to collect waste from these community bins/containers through handcarts, tricycles, pick-up vans, or other waste collection vehicles as may be convenient, on a daily basis.

To facilitate the collection of waste from societies or commercial complexes, the local bodies should, by a rule, make it obligatory for them to identify an appropriate site within their premises for keeping such bin / container for the storage of waste.

3.4.5 Collection of Waste from Slums

The local body shall collect waste from slums by bell ringing and whistle system along their main access-lanes. Residents should bring their waste from their houses to the hand-carts. Where slum residents prefer community bins, they should bring their bio-degradable waste to these bins only an hour or two before the time of clearance. The local body may, if so desired, engage a private contractor for collection of this waste. Performance certification by a "Mohalla Committee" may be insisted upon in such cases.

3.4.6 Collection-at-the door-in posh residential areas

In posh residential areas where the residents might not be willing to bring their waste to the municipal handcart/ tricycle, collection-at-the-door pick-up of waste may be introduced for picking up domestic waste from households daily on a full cost recovery basis and an NGO or contractor may be encouraged to provide such service.

3.4.7 Collection of duly segregated recyclable / non-biodegradable waste from households

NGOs may be activated to organise the rag-pickers and convert them into door-step waste-collectors to improve their quality of life and to reduce their health risk. This will also increase their income levels. NGOs may allot to such waste collectors specified lanes and bye-lanes comprising of 150 to 250 houses for doorstep collection of recyclables. They may also be given identity cards by the NGOs for increasing their

acceptability in society. NGOs and/or the Corporation may support such waste collectors by giving them bags and tools required for collection of recyclable waste from the doorsteps. The local body may also inform the people of the arrangements made by the NGO and advise them to avail of the services as illustrated in the photograph below:-



Photo-28 : House to house collection of recyclable waste through a waste collector (upgraded ragpicker) – an NGO effort.

3.4.8 Collection of Waste from Shops and Establishments

Shops and establishments normally open after 9 or 10 am. These timings do not synchronise with the usual work schedule of sweepers. Under this situation one of these three alternatives may be adopted.

1. Sweepers may first carry out the work of street sweeping in the morning hours as usual and soon thereafter take up the work of door-step collection of waste, after most of the shops have opened.
2. Waste collectors (rag pickers) may be organised to collect the recyclable waste from shops and establishments as soon as they open, as most of such waste is recyclable. Working arrangements may be made with the shops and establishments accordingly. The shops & establishments may be asked to store waste in two bins if they also produce waste other than recyclable waste. This arrangement may be made on 'No payment' basis on either side.

The recyclable material received by the waste collectors directly from shops and establishments would give them a better return. The waste would be dry and not soiled and would fetch a good price in the market. This will work as an incentive for them to continue door to door collection.

The associations of markets, shops and establishments may be persuaded to organise this service with the help of NGOs and rag-pickers in their market.

Note of caution:

Rag picking is an informal income-generating activity undertaken by a poor strata of society. The suggestion to improve their lot by upgrading them to the level of doorstep waste-collector is only with a view to improve the quality of life of the rag-pickers, relieve them from the dirty work of picking up soiled and contaminated waste to earn their living, integrate them in the mainstream of society by giving them access to the houses, shops and establishments to collect recyclable waste from the door-step in the same informal manner. The rag-pickers should not, therefore, be given any formal employment on a daily or monthly wage by the local body or even by the NGOs as it may attract the provisions of labour laws. The NGOs should only help in improving their lot by organising them and need not play the role of their employer for primary collection of recyclable waste from the doorstep. At the same time they should not be prevented by law from engaging in this occupation.

3. Doorstep collection service from shops and establishments shall be provided or may be contracted out on 'full cost-recovery' basis.

3.4.9 Collection of Bio-medical Waste

The collection of bio-medical waste should be done in accordance with the directions contained in the Government of India, Ministry of Environment Notification dated 20th July 1998. The liability for the disposal of bio-medical waste is now on the waste producer. Therefore, the local body as such is not liable to provide any service. However, if the local body desires to help the hospitals, nursing homes and other health care establishments in the matter of handling and disposal of bio medical waste, it may assist them on full cost recovery basis and extend a helping hand without taking over any legal responsibility.

The hospitals and nursing homes in the city may be divided into convenient groups and routes may be mapped out for the doorstep collection of hospital/nursing home waste. The hospitals may be directed to keep sealed bags at one safe place to be handed over to the collection staff. This may be done by the association of medical practitioners etc. through contractors. The association may, if it so desires, get this work done departmentally by having their own vehicles which meet the requirements of the aforesaid Notification. In case the local body desires to extend help in the matter of primary collection of waste, it may do so strictly in conformity with provisions of the above Notification on full-cost-recovery basis. The cost could be recovered on pro-rata basis depending on the number of beds or quantity of waste collected from such establishments.

3.4.10 Collection of Hotel and Restaurant Waste

The hotels and restaurants may make their own arrangements for collection of waste through their own association, or the local body may extend help in primary collection of such waste by deploying its own manpower and machinery for door-step collection of such waste on full-cost-recovery basis. The cost could be recovered on pro-rata basis. This doorstep service may be contracted out by the local body if so desired.

Charges for the collection of hotel waste may depend upon the quantity of waste to be picked up from the hotels and restaurants and frequency of collection required.

The cost recovery may be planned according to the classification of hotels / restaurants made on the above basis and decided in consultation with them.

A survey of the waste generation of the hotels / restaurants may be made before the collection rates are introduced and notified.

3.4.11 Vegetable, Fruit, Meat and Fish Market Wastes

These wastes should be removed on a daily basis departmentally or through a contractor on full or part-cost-recovery basis as may be deemed appropriate by the local body.

The large containers kept in the fruit and vegetable markets should be properly emptied during non-peak hours and the waste from meat and fish markets should be collected through a closed pick-up van service by engaging a contractor, or departmentally as deemed expedient by the local body.

3.4.12 Collection of garden waste

The waste stored in public and private parks, gardens, lawn plots etc. should be collected on a weekly basis by arranging a rotation for collecting such waste from different areas, on different days to be notified to the people to enable them to trim the trees and lawns accordingly and keep the waste ready. This waste may be collected through a contractor or departmentally as deemed appropriate by the urban local authority. Cost recovery shall be insisted upon, based on the volume of waste collected.

3.4.13 Collection of waste from marriage halls, Kalyan Mandaps, community halls, etc.

A special pick up arrangement should be made for the collection of waste from these establishments daily on a full-cost-recovery basis. The cost of such collection could be built into the charges for utilising such halls. This service may be provided preferably through a contractor or departmentally as the local body deems fit. On-site processing of food waste by bio-methanation may be encouraged.

3.4.14 Collection of construction and demolition waste

1. The local body should prescribe the rate per ton for the collection, transportation and disposal of construction waste and debris and notify the same to the people.
2. Every person who is likely to produce construction waste may be required to deposit with the local body an approximate amount in advance at the rates that may be prescribed by the local body from time to time, for the removal and disposal of construction waste from his premises by the local body. Such amounts may be deposited at the time when building permission is being sought and in cases where such permission is not required, at any time before such waste is produced.
3. The charges for removal of construction waste should be doubled for those who fail to deposit the amount in advance.
4. To facilitate the collection of small quantities of construction and demolition waste generated in the city, suitable sites may be identified in various parts of the city and notify where people should deposit small quantities of construction and demolition waste. Containers could be provided at such locations and a small collection charge levied for receiving such waste at such sites and for its onward transportation. Rates may be prescribed for such collection by the local body. Contracts could be given for managing such sites.

3.4.15 Dairy and cattle-shed waste

In the cities above 5 lakh population, the dairies and cattle breeders having sheds within the city limits should be asked to move the cattle sheds outside the city limits. Such waste producers in all Class-I cities should be directed not to stack the cow dung or other stable waste within their premises or on the roadside or drain for future use or sale, as it creates insanitary conditions. They must, therefore, transfer the waste produced by them daily into the specified municipal storage containers nearby.

3.5 SWEEPING OF STREETS & PUBLIC SPACES

Daily sweeping of public streets is essential where there is habitation close by. Isolated pockets or roads with little or no habitation around do not require daily cleaning but at the same time they cannot be ignored. A schedule of street cleaning should be prepared, prioritising the roads requiring daily cleaning and the ones which need to be cleaned periodically.

MANDATORY RECOMMENDATIONS:

ALL PUBLIC ROADS, STREETS, LANES AND BYE-LANES HAVING HABITATION OR COMMERCIAL ACTIVITY ON ONE OR BOTH SIDES OF THE STREET SHALL BE CLEANED ON A DAILY BASIS, ASSIGNING A CLEARLY DEMARCATED AREA TO EACH SWEEPER, AND STREET SWEEPINGS SHALL BE DEPOSITED IN THE CONTAINER PLACED AT THE TEMPORARY WASTE STORAGE DEPOT ESTABLISHED IN THE CITY.

The following measures may be taken to ensure regular sweeping of streets and public places:

3.5.1 Street sweeping to be done on a daily basis.

Sweeping of the public roads, streets, lanes, by-lanes should be done daily if there is habitation or commercial activity on one or both sides of the street. A list of such roads and streets together with their length and width should be prepared and a program for their daily cleaning should be worked out by the local body keeping in view the norms of work (yardsticks) prescribed. Roads and streets with no cluster habitation which do not require daily cleaning may be put in a separate group and may be taken up for need-based cleaning on alternate days, twice a week, once a week or occasionally, as considered appropriate by the urban local body. Similarly a timetable should be prepared for the cleaning of open public spaces daily or periodically to ensure that they do not become dump yards and remain clean.

3.5.2 All SWM services to be provided daily, including on Sundays and Public Holidays

(a) Working on Sundays

The generation of waste is a continuous process. As waste is produced each day, collection, transportation and disposal of waste is required to be done daily. There can therefore be no holiday in street sweeping, primary collection, transportation, processing and disposal of waste. All local bodies should therefore re-organise their work schedule and ensure that the Sanitation Department functions on all days in the year irrespective of Sundays and public holidays. This does not mean that Sanitation Department staff shall have no weekly off or holidays. The sweepers and other staff engaged in collection, transportation and disposal of waste as well as supervision of sanitation services should be given their statutory weekly off by rotation instead of giving them off on Sunday, by dividing the staff into seven groups and each group getting a weekly off on one of the days of the week. Thus 1/7th of the staff should be enjoying their weekly off on each day of the week. This will necessitate staff consolidation or creation of additional posts to the extent of 1/7th of the total strength of the staff in the cities where no cleaning is presently done on Sundays.

Alternatively, the staff may be given two half days (afternoons) off in a week in lieu of one full day weekly off if the sweepers agree to such an arrangement. Here the sweepers may leave work after working for 4 hours on two days out of seven days of the week to make up their weekly off. Perhaps they may be happy to have two half holidays instead of one weekly off in a week as they will have more time for themselves and the family twice a week. However, since this has legal implications, such arrangements will have to be worked out by mutual consent.

This arrangement of giving two half days' leave in lieu of one full day weekly off, may be made applicable to street sweepers, drain cleaners and their supervisors only and not to the transportation workers or workers engaged in the disposal of waste, as these activities have to continue for full shifts of the day. 1/7th additional staff may be engaged in these sections of the SWM department to make up the requirement of working on all the days, or overtime may be given as per the need to complete the day's work.

(b) Review of Holidays given to the staff working in essential services such as Collection, Transportation, Processing and Disposal of Waste.

The list of public holidays being given to staff engaged in essential services vis-a-vis general category staff should be reviewed by the local body. Normally the number of holidays given to essential services staff are less than half the number of holidays given to general category staff. After review, the local body may finalise the number of holidays to be given to the sweepers and other staff in SWM. Thereafter it may make necessary arrangements for the collection, transportation and disposal of waste on all public holidays by either suitably compensating existing workers for holidays or by creating additional mechanisms to carry out the work on public holidays. The staff can also be compensated by giving additional earned leave in lieu of a public holiday, or additional salary/allowance as deemed proper. This suggestion does not preclude continuance of existing arrangements, if any, made by the local body to provide SWM services on public holidays.

3.5.3 Substitution of Sanitation Workers

When any sanitation worker remains absent or proceeds on leave, alternate arrangements must be made to ensure that cleaning is done as usual. Badli workers or leave reserve could be used for this purpose. Any other satisfactory arrangements that are currently in use for this purpose may continue. Work must not suffer on account of absenteeism.

3.5.4 Prevent Burning of Waste by Sweepers and the Public

All urban local bodies should take measures to prevent burning of tree leaves and other waste by sweepers on the roadside and direct their sweepers to take all waste to the communal waste storage bins/sites only. Action may be taken against erring employees. Where open spaces are available nearby, the leaves could be rapid-composted and used locally as organic manure for roadside plantations.

3.6 Tools to be given to Sweepers

Use of appropriate tools plays an important role in improving the efficiency of the work force. Presently most of the tools used by sanitation workers are inefficient and outdated, and need to be replaced by efficient tools and equipment. Traditionally the work force resists any change, even if it is for their good. Persuasion and awareness efforts will therefore be necessary to convince the workforce to adopt improved tools and equipment.

The following recommendations may be considered by the urban local bodies.

3.6.1 Brooms

Instead of using short-handled brooms which require bending of the body while at work, cause fatigue to the workforce and cause back pain in the long run, the workforce may be advised to use long-handled brooms as shown below which will not require bending, will reduce fatigue and increase their productivity. In cities where a broom allowance is given, or only broom sticks are provided to sweepers, they may be persuaded that long-handled brooms may be used or made by them for street sweeping. While making such brooms, a metal blade which can scrape the material sticking on the street should be fixed on the top of the broom, or a separate metal scraper may be given to the sweepers, to remove sticky material from the street while sweeping.



Photo - 29 : A long handled broom utilised for street sweeping.

There is no yardstick about the number of brooms to be given to sweepers per month. In some cities three brooms per month are given whereas in other cities only one broom is given per quarter of a year. One long-handled broom per month is considered to be adequate for street sweeping. The bamboo (long handle) to which the broom is attached has a long life and can be reused for 6-12 months.

3.6.2 Metal Tray and Metal Plate

Each sweeper engaged in street sweeping should be given a metal tray and a metal plate for facilitating easy transfer of street sweepings from the streets into the handcart.

3.6.3 Hand-Carts / Tricycles

Each sweeper engaged in street sweeping should be given a hand-cart having 4 to 6 containers or a tricycle having 8 or more containers of 30 to 40 litres capacity each as illustrated below, for ease of handling. These containers should be detachable to facilitate the direct transfer of street sweepings and household waste from the container into the communal waste storage bins. Such containers should be lockable with a chain arrangement. The hand-cart should have at least 3 wheels with sealed ball bearings so that it can be used efficiently.

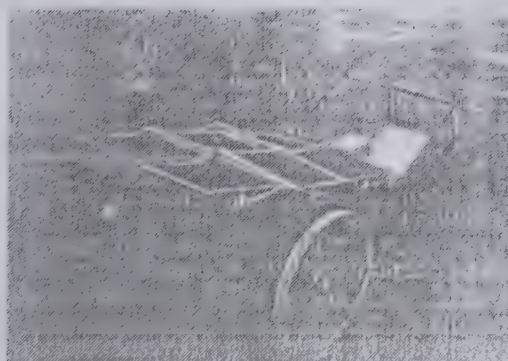


Photo – 30 : Six-container hand-carts proposed to be used for primary collection of waste.

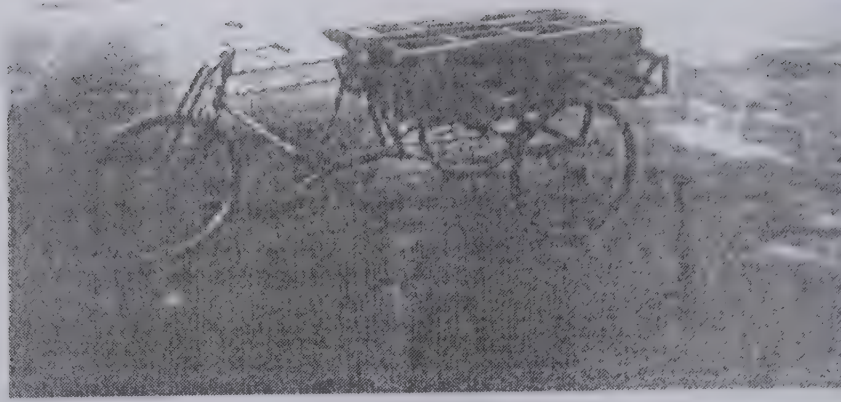


Photo - 31 : Eight containered tri cycle proposed to be used for primary collection of waste.

3.7 NORMS OF WORK FOR STREET SWEEPERS

Sweepers should be assigned fixed individual beats ("Pin-point" work) according to the density of the area to be swept. The yardstick of work may be prescribed by the urban local body depending on the local situation, type of roads and amount of effort required to be put in by the sweeper. However, the following guidelines may be considered while prescribing these norms:

1. High density area = 250 to 350 running meters (RMT) of road length
2. Medium density area = 400 to 600 running meters (RMT) of road length
3. Low density area = 650 to 750 running meters (RMT) of road length.

The sweepers may be directed to sweep the roads and footpaths in the area allotted to them as well as collect the domestic, trade and institutional waste in their handcart/tricycle from all the households, shops and establishments situated along the stretch of road/street allotted to them.

The above sweeping norms are for cleaning the streets in the first 4 hours of the working day. In the remaining hours of the day, if there is a continuous 7 to 8 hours' duty, or in the evening spell, if there is broken duty, the sweepers should be assigned "pin-point" work for cleaning the streets in slums and unauthorised settlements to ensure hygienic conditions in the city and prevent the problems of health and sanitation arising in such areas. Depending upon the density of slums, pin-point work may be allotted to the sweepers keeping in view the above yardsticks.

In the areas where there are few slum pockets and there is a major problem of cleaning of surface drains, the afternoon hours could be utilised for cleaning the surface drains in their respective beats.

Roads which have a central verge or divider should be considered as two roads. In such cases the length of the road allotted for sweeping should be reduced to half, or alternatively separate sweepers may be engaged for sweeping two sides of the road.

The yardstick for cleaning open spaces should be prescribed based on local conditions. However, 30,000 sq. ft. of open space can be given to a sweeper for cleaning per day.

3.7.1 WORKING HOURS

Different cities have adopted different working hours depending on local conditions and age-old traditions. It is desirable to start work as early as possible in the morning so that the city looks clean before the roads and streets get busy in the morning.

Normally the labour force is required to work for 8 hours and is given half an hour's recess. Considering the type of work, it is desirable to split the 8 hours of duty of sweepers into two spells, 4 to 5 hours in the morning and 3 to 4 hours in the afternoon and the work force should be fully utilised in both the spells of duties. Quite often the work force is utilised in a group in the afternoon hours, which is highly unproductive. Individual work needs to be allotted to each person in both spells to ensure full output and accountability. The local body may decide the duty hours on the above lines and the total hours of work to be taken from the sweepers, subject to government policy, court orders and union agreements.

3.8 Cleaning Of Surface Drains

In many cities there are open surface drains beside the road, into which quite often the sweepers and the public dispose of waste un-authorisedly. These drains need to be cleaned on a regular basis to permit free flow of waste-water. Action should be taken to ensure that sweepers and citizens do not dispose of any waste into drains.

Initially, drain cleaners reporting to the SWM Department should be given the work of cleaning shallow surface drains (not more than 24" depth) upto 500 meters length per day and this length may be increased as soon as the discharge of solid waste into the drain is substantially reduced. Necessary tools should be given to the drain cleaners. They should also be given suitable seamless handcarts and shovels for transferring the silt to sites identified for depositing it. The periodicity of cleaning such drains should be worked out based on the conditions and frequency of clogging of drains. The Roster of Cleaning of such drains should be worked out and strictly followed.

Whatever waste is removed from the drains should not be allowed to remain outside the drain for long for drying. It would be desirable to deposit the wet silt into a seamless hand-cart as soon as it is taken out from the drain. If that is not possible or is found difficult, the silt may be allowed to dry for about 4 hours outside the drain before transporting the semi-solid silt for disposal.

In special situations a maximum of 24 hours should be allowed for removal of such waste. Seamless handcarts may be used for transfer of silt from the surface drain site to the waste storage depot. Shovels should be used for transferring the contents from the seamless hand-cart or tricycle to a larger container kept at the temporary storage depot or communal waste storage site.

If this work can be contracted out, the contractor should ensure that the silt removed from the drain is similarly lifted promptly and taken to the disposal site as per the terms of contact.

3.9 Removal of Silt from Underground Drains/Manholes

The work of removal of silt from underground drains or manholes, storm-water drains or surface drains deeper than 24", should be done by the Engineering Division of the local body and this work should not be entrusted to the SWM department. The silt so removed should not be kept on the road or footpath for drying. This waste should be removed on the same lines as suggested for silt removed from the surface drains. Wet waste only should be removed immediately from the main roads in less than 4 hours, and in other areas within 24 hours, and taken to the disposal site to prevent nuisance and health hazards. This waste should not be taken to the compost plant, but may be used as landfill cover.

3.10 PROVISION OF LITTER BINS

For keeping the streets clean it is necessary to provide facilities of litter bins all over the city so that people can deposit the litter in hand into such bins while on the move and keep the streets litter-free.

MANDATORY RECOMMENDATION

ADEQUATE NUMBERS OF LITTER BINS SHALL BE PLACED IN URBAN AREAS AT RAILWAY STATIONS, BUS STATIONS, MARKET PLACES, PARKS AND GARDENS AND IMPORTANT COMMERCIAL STREETS TO PREVENT THE LITTERING OF STREETS AND PUBLIC PLACES.

The following action may be taken by the urban local bodies:

To enable citizens to dispose of their waste-in-hand such as used cans or cartons of soft drinks, used bus tickets, wrappers of chocolate or empty cigarette cases and the like, litter bins must be provided at all railway stations, bus stations, in all market-places, places where people gather or wait in queues and on important roads at reasonable distances ranging from 25 to 250 meters depending on local conditions.

Such bins could be of the design shown below. The removal of waste from these litter bins should be done by the pin-point beat sweepers during their street cleaning operations. The waste from the litter bin should be directly transferred into the hand-cart of the sweeper.



Photo – 32 : One among the various designs of litterbins being utilised for disposal of litter at a public place.

Such facilities can be created at no cost to the local body by involving the private sector and giving them advertisement rights on the bins for a specified period or by allowing them to put their names on the bins as a sponsor. Litter bins should be put in posh as well as poor areas and the sponsor should put such bins in both the areas in the proportion decided by the local body.

3.11 Temporary Waste Storage Depots for onward transportation of waste

The solid waste collected from the doorstep or from the community bin by the primary collection system has to be unloaded and stored at a convenient place for its onward transportation in a cost-effective manner. Temporary waste storage depots are, therefore, required to be created at suitable locations in lieu of open waste storage sites, cylindrical, masonry or such other bins. The local body should, depending upon the system of Primary Collection adopted in the town, identify the locations where community waste storage facilities shall be created.

MANDATORY RECOMMENDATION:

ALL OPEN WASTE STORAGE SITES SHOULD BE ABOLISHED EXPEDITIOUSLY AND ALL DUST BINS MADE OF CEMENT PIPES, METAL RINGS, MASONRY CONSTRUCTION SHOULD ALSO BE REPLACED IN A PHASED MANNER BY A TEMPORARY WASTE STORAGE FACILITY IN THE FORM OF A NEAT MOBILE CLOSED-BODY LARGE CONTAINER, OR A PARKED VEHICLE, FOR TEMPORARY STORAGE OF WASTE THROUGH CONTAINERISED HAND-CARTS / CONTAINERISED TRICYCLES ETC., FROM THE DOOR STEPS AND/OR FROM THE COMMUNITY BINS FOR ONWARD TRANSPORTATION OF WASTE IN A COST EFFECTIVE MANNER.

The following alternatives can be considered.

Provide large metallic containers (3 to 10 cu. mtrs) with lid as illustrated below, at a distance not exceeding 250 meters from the place of work of the sweepers. The distance between 2 bins should, therefore, not exceed 500 meters. The distance between the bins can be determined on the basis of the load of garbage/refuse that is likely to be received at the container from the area concerned. The bins should be placed on cement, concrete or asphalt flooring having a gradual slope towards the road to keep the site clean. The flooring should be flush with the border of the road to maintain hygienic conditions and facilitate the transfer of waste from the handcart/tricycle into the container. A catch pit may be provided close by if a storm-water drain exists in the city.



Photo – 33 : A large container placed on a concrete floor at the waste storage depot in lieu of street bins.

1. In areas where placement of large containers is found inconvenient, small containers of 0.5 to 1.00 cu. mtr.size as illustrated below may be placed on the roads, lanes and bylanes at short distances not exceeding 100 meters. These bins should also be kept on paved flooring as shown in option (1) and cleared daily.

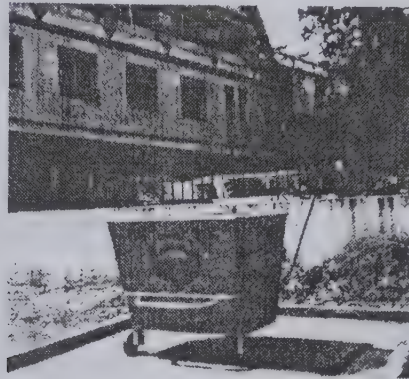


Photo – 34 : Small container placed at short intervals in lieu of large container at longer distances.

2. Another option that could be used in such a situation is to avoid placing a container altogether and, instead, press into service a small waste-collection vehicle for the direct transfer of waste from hand-carts / tricycles into such vehicles. Such vehicles can be parked at suitable locations in congested areas where sweepers can bring the waste easily as can be seen from the photograph below.



Photo – 35 : Small vehicle utilised for the direct transfer of waste from the congested residential areas in lieu of placing a large container.

3. In small cities where the local body feels that it will be difficult to maintain hydraulic vehicles for the transportation of such containers, they should place at the identified site a low-bed tractor trolley or containers which can be towed away by a tractor or a similar prime mover.

3.12 TRANSPORTATION OF WASTE

The system of transportation should be such that it can be easily maintained in the city departmentally or through private garages and the system should appropriately match with the system adopted for the storage of waste at the dust-bin site i.e. at the temporary waste storage depots. Manual loading should be discouraged and phased out expeditiously and replaced by direct lifting of containers through hydraulic system, or non-hydraulic devices, or direct loading of waste into transport vehicles.

MANDATORY RECOMMENDATION:

TRANSPORTATION OF WASTE SHALL BE DONE REGULARLY TO ENSURE THAT THE CONTAINERS / TROLLEYS AND DUSTBIN SITES ARE CLEARED BEFORE THEY START OVER-FLOWING. THE FREQUENCY OF TRANSPORTATION SHALL BE ARRANGED ACCORDINGLY. THE SYSTEM OF TRANSPORTATION OF WASTE MUST SYNCHRONISE WITH BULK STORAGE OF WASTE AT THE TEMPORARY WASTE STORAGE DEPOTS. MULTIPLE AND MANUAL HANDLING OF WASTE SHOULD BE AVOIDED.

The following measures may be taken to meet the above objectives:

3.12.1 Domestic/Trade/Institutional Waste

The transportation of waste from the temporary waste storage depots / sites may be planned in accordance with the frequency of containers becoming full. The locations where the containers are placed may be grouped into four categories as under:

- (a) Containers which are required to be cleared more than once a day.
- (b) Containers which are required to be cleared once a day.
- (c) Containers to be cleared on alternate days.
- (d) Containers which take longer time to fill and need clearance twice a week.

3.12.2 Routing of vehicles

Depending on the containers to be cleared each day, the route for lifting the container may be worked out avoiding zig-zag movement of the vehicle to the extent possible. In large cities, routing-theory studies can help save a lot of fuel.

3.12.3 Use Of Vehicles in Two Shifts

All the vehicles may be utilised in two shifts to lift containers, to ensure full utilisation of the fleet of vehicles and to reduce the requirement of new vehicles.

Transportation of waste during night time may be done in areas where there is serious traffic congestion during the day and it hampers SWM operations. Work at night will increase the productivity and reduce the cost of the service.

3.12.4 Type of Vehicles to be used

1. Container lifting devices such as dumper placers and skip lifters or similar vehicles may be utilised for the transportation of large sized containers to the transfer station or to the disposal site as illustrated below:



Photo – 36 : Transportation of large closed-body container.

2. At places where small size containers of 0.5 to 1.0 cu. mtr. may have been placed, the refuse-collector machine without compaction devices, of 6 to 15 cu. mtr. capacity having top or back loading facility, may be utilised. This vehicle, instead of transporting the container as at (1) above lifts and unloads the contents of the small container into the body of the vehicle through a hydraulic system and lowers the empty container back in place.

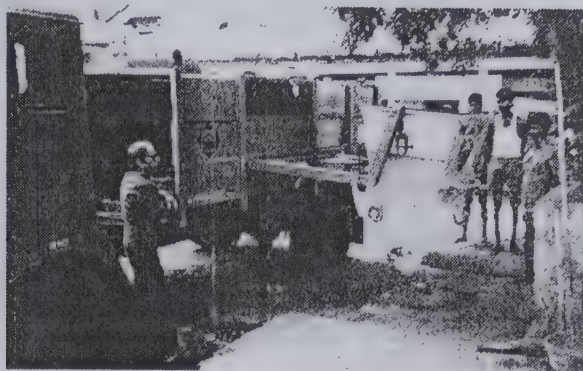


Photo-37 : Lifting of small container for emptying the contents.

3. In small cities with poor repair and maintenance facilities, where hi-tech vehicles may not work efficiently, tractor-trolley combinations or lifting of containers or towing of containers by tractors may be utilised. Simple hydraulic tipping-trailers are recommended to avoid manual unloading at the compost-yard.

3.12.5 Bio-Medical Waste From Hospitals, Nursing Homes, Health Care Establishments

The transportation of bio-medical waste has to be arranged by the waste producers or their association. The instructions contained in the Biomedical Waste (Management and Handling) Rules 1998 may be followed. The Biomedical waste stored in colour-coded containers/bags transported in closed-body vehicles from the hospitals and nursing homes to the treatment and/or disposal site is shown in the photographs below. Generally one vehicle may be deployed for 50 to 70 units depending on the size of the establishments and distances between them. This work may either be done by an agency selected by the Medical institutions producing biomedical waste, or their association or, on their request, by the local bodies on full-cost-recovery basis. This service may be contracted out under the active supervision and control of the association or local body. 33% standby-vehicles may be kept for ensuring reliable service.



Photo – 38 : Bio-medical waste kept ready for transportation in colour coded bags



Photo – 39 : Transportation of Bio-medical waste.

3.12.6 Transportation of Waste From Hotels & Restaurants

The hotel and restaurant waste should be collected once or twice daily through a contract given by the association of hotels and restaurants, or at their request by the local body on a cost-recovery basis. Doorstep collection systems may be introduced for the collection of this waste. Either a refuse-collector with back-loading facility or a motor vehicle with closed body may be used. This entire collection and transport system could be privatised and rates may be prescribed by the association or local body. 33% spare vehicles may be kept to ensure reliable service. Very strict supervision by the ULBs of this service, from pick-up until unloading at compost-yard, is necessary.

3.12.7 Transportation of Construction Waste and Debris

Disposal of construction and demolition waste and debris is the liability of the waste producer. If such waste is not promptly removed in a reasonable time prescribed by the local body, it may be removed by the local body on full-cost-recovery basis. One of the following methods may be adopted for transportation of construction waste and debris:

In very large cities where a skip-renting system can be introduced, the skips may be transported by hydraulic system at a time mutually agreed upon between the local body and waste producer.

1. In cities where a sufficient cost-recovery fee has been deposited by the waste producer for the removal of construction waste, such waste may be loaded mechanically into skips or vehicles using front-end-loaders. One front-end-loader and 3 trucks can transport 100 to 150 tonnes of construction waste in one shift.
2. In small cities under 5 lakh population the construction waste may be manually loaded into trucks or tractor-trolleys and transferred to the disposal site.

Since all such waste must be cleared sooner or later, the more promptly this is done the cleaner the city will be and the less traffic obstruction there will be.

3.12.8 Transportation of Waste From Narrow Lanes

Quite often a small quantity of waste is disposed of in narrow lanes, which cannot be removed by sending out the usual transport vehicle. Loading rickshaws or traditional carts or animals may be used for removal of such waste manually but very promptly.

3.13 Setting Up Of Transfer Station

In large cities where the disposal site is more than 10 km. away from the city boundary and smaller vehicles are used for the transportation of waste, it may prove economical to set up transfer stations to save transportation time and fuel provided the city has a good performance record of vehicle maintenance and adequate facilities to maintain large sized vehicles and containers. Large sized 15 to 20 cu. mtr. containers could be kept at the transfer station to receive waste from small vehicles. A ramp facility may be provided to facilitate unloading of the vehicles or Dumper Placer (DP) containers, directly into large containers at the transfer station. Construction of complicated and expensive transfer stations must be avoided.

The requirements of large containers and vehicles may be worked out on the basis of the total quantity of waste expected to be brought to the transfer station and the number of trips the vehicles will be able to make in two shifts each day.

3.14 Workshop Facility For Vehicle Maintenance

All local bodies must have adequate workshop facilities for the maintenance of their fleet of vehicles and containers, handcarts etc. Such facilities may be created by the local body departmentally or through a contractual arrangement. The workshop, public or private, should have adequate technical staff, spares and preventive maintenance schedules to ensure that at least 80% of the vehicles remain on the road each day and the down time of repair maintenance is minimised to the extent possible. Spare assemblies should be kept available which could be given as replacements until necessary repairs are carried out. The workshop should be preferably headed by an automobile engineer or mechanical engineer.

Team incentives should be introduced in departmental workshops for ensuring that more than 80% of vehicles remain on the road throughout the month.

The workshops should preferably be run in more than one shift. Technical staff as per the requirement may be kept in the second or third shift to ensure optimum utilization of the fleet of vehicles of the local body.

Since waste-transport vehicles have a useful life of 8-10 years, financial planning must ensure timely replacement of vehicles to minimise down time and repair costs.

3.15 PROCESSING AND DISPOSAL OF WASTE

Human habitation generates large quantities of waste, which has a significant component of putrescible waste. In urban areas these wastes are disposed of unscientifically by dumping them in low lying areas and injuring health and the environment through land, water and air contamination.

With the passage of time, more and more land in and around the urban areas is being used for the dumping of waste and the availability of such lands is also becoming scarcer from year to year. There is, therefore, an urgent need to stop the crude and unhygienic method of open dumping of waste and to adopt methods where the useful components of waste are utilised for the good of society and only rejects are disposed of scientifically in an environmentally acceptable manner. This will reduce the day to day requirement of land for disposal of waste.

Nowadays, several technologies are being advocated by private entrepreneurs for the processing, treatment and/or disposal of municipal solid waste. Some have Indian experience such as microbial composting, vermi composting, whereas some are based on applications in foreign countries which are yet to be tried successfully or have failed in India, such as incineration, power generation and fuel pelletisation. Several local bodies have made MOUs and agreements with such firms for setting up plants, with or without the support of government. Some plants have come up successfully whereas many have not seen the light of day. Some local bodies have been doing composting of waste on their own, departmentally, with very limited success.

Most local bodies lack the competence to assess the suitability of technology which may work under Indian conditions with the type of waste produced in Indian cities. Quite often, local bodies are carried away by technology utilised in developed countries without evaluating its applicability under Indian conditions and therefore meet failure later. Much valuable time and money is wasted in such experimentation by local bodies.

It is therefore necessary that before adopting a new technology proposed by those having no Indian experience, particularly in the areas of power generation, fuel pelletisation or incineration of ordinary municipal solid waste and where no plant has come up successfully in India, local bodies must carefully look into various options available and choose a technology for the processing of waste which suits the local conditions.

The following criteria could be adopted when selecting waste processing and disposal technologies:-

1. Indian experience or proven foreign technology suitable under Indian conditions.
2. Capital investments required.
3. Requirement of land, water and power.
4. Recurring expenditure.
5. Economy of operation.
6. Manpower needs.
7. Level of skill required.
8. The capability of the local body to manage such facility departmentally or through private sector participation.

9. Scale of operation.
10. Environmental impact of such technology.
11. Process aesthetics.
12. Cost of end products.
13. Compatibility with the cycle of nature.

The local bodies lacking adequate in-house capacity to assess the suitability of technological options, should in their own interest seek expert opinion. The Technology Mission recommended in Chapter-10, and, until it is constituted, from the Central Pollution Control Board or the Ministry of Urban Development, Environment, Agriculture or Non-Conventional Energy Sources could be approached for such expert opinion.

OPTIONS AVAILABLE TO LOCAL BODIES

3.15.1 Composting

Composting is a slow natural process in which mixed bacteria, fungi, insects and worms consume plant and animal waste and convert them slowly into a soil-like substance very beneficial to plant growth. Compost provides energy, minerals, nutrients and micro-nutrients, useful microbes and water-retaining humus to the soil. This improves the quality and pest-resistance of produce, makes crops drought-resistant and decreases irrigation water requirements. The use of compost to enrich the soil, along with chemical fertiliser in a balanced ratio, is therefore very necessary. This view has been repeatedly expressed by government bodies as well as the fertiliser association for over a decade. Compost can find a good market if properly promoted and made conveniently available to the farming community.

Composting can be done by aerobic and anaerobic processes. The aerobic wind-row process can now be completed in 45-60 days, on any scale, even with mixed non-toxic waste, by repeated turning and aeration.

Vermi-composting is a process in which earthworms consume decayed plant and animal waste with the help of bacteria in their gut, to excrete fine-grained soil-like vermi-castings rich in minerals and microbes, very beneficial to plants and free of disease germs. Many other soil organisms assist in the breakdown and conversion of bio-degradable waste. It is best suited to segregated bio-degradable waste on a small scale in de-centralised locations.

Anaerobic composting processes are very slow. They take about 180 days to produce compost in airless pits or trenches in the ground, and generate methane, an environmentally harmful green-house gas. Anaerobic composting can be accelerated in bio-gas digesters, where the harvested methane becomes a useful fuel and the slurry produced is a useful organic manure. As temperatures inside bio-gas digesters are not high, pathogens are not killed. It is useful for cooked food waste in de-centralised operations.

3.15.2 Sanitary Landfilling

This is a term often mistakenly used by Municipalities to refer to open dumping, presently the most common method of waste disposal, which causes problems of subsoil-water contamination. True Sanitary Landfills for untreated mixed wastes require impervious soil strata or liners at the bottom, plus bottom piping for collecting and pumping out leachate for treatment and re-circulation, along with piping arrangements to collect, extract and use part of the methane gas generated in such anaerobic conditions. The waste is also to be covered daily by soil or inert material in scientifically managed cells. These precautions are expensive but necessary.

With available land for waste disposal becoming more and more scarce every year, efforts must be made to strictly minimise the waste going to landfills, by segregating non-biodegradable waste for recycling and by composting bio-degradable waste. Landfilling should be used only as the last step in the waste-processing chain, not for untreated mixed waste. Only rejects should be landfilled, in a scientific manner, once compost plants are set up.

3.15.3 Incineration

This is a thermal process for burning the waste at a very high temperature. Incineration requires high calorific value waste, which can burn without any external fuels. Indian waste contains only 3 to 7% of combustibles, paper and plastic by the time the waste reaches the disposal site. This is principally because most of the burnable material is retrieved by rag pickers from the waste lying on the streets, dust bins and dump yards. This calorific value of Indian waste at the dump yards is found to range from 800 to 1000 Kcal/kg., which is very low. The system of incineration is therefore not suitable under Indian conditions for this and the following additional reasons:

1. High ash and dust contents of Indian waste.
2. The system is not environmentally friendly.
3. High capital cost, especially for adequate control of emissions.
4. High Operation and Maintenance cost.

The system requires high technical skill to man it.

The incineration of general municipal waste is therefore not recommended as a method of Municipal Solid Waste disposal.

Incineration of specified Bio-medical waste is however unavoidable and is strongly recommended for the maintenance of health of the citizens.

3.15.4 Power Generation, Fuel Pellets, and Bio-Methanation Etc.

These processes are being advocated in some quarters and serious efforts are being made through research and development to generate power via high-rate bio-methanation. Efforts are also being made to produce fuel pellets from municipal waste. This Committee is not in the know of any such plant successfully operating in India. It is therefore, suggested that local bodies should not experiment with any such expensive technology until after adequate experimentation and one or two successful pilot projects, to the scale corresponding to the technologies, they have been proven and Government of India Ministry of Non-Conventional Energy Sources, Ministry of Environment, Ministry of Urban Development or any other agency identified by Government of India have advised them to adopt such technology or have certified that the technology is proven and can be adopted in Indian conditions.

3.15.5 CHOICE OF TECHNOLOGY

Given the technological options available for processing and disposal of waste at the present juncture, only composting of organic/food and bio-degradable waste and disposal of rejects at the landfill sites is recommended.

3.16. RECOMMENDED PROCESSING AND DISPOSAL OPTIONS

MANDATORY RECOMMENDATIONS

ALL ORGANIC / BIO-DEGRADABLE WASTES COLLECTED FROM HOUSEHOLDS, SHOPS, MARKETS, HOTELS AND OTHER ESTABLISHMENTS SHALL FIRST BE COMPOSTED BY FOLLOWING SUITABLE METHODS OF COMPOSTING WITH OR WITHOUT POWER GENERATION AS DEEMED APPROPRIATE.

ONLY REJECTS & DOMESTIC HAZARDOUS WASTE SHALL BE CAREFULLY LANDFILLED. BIO MEDICAL WASTE SHALL BE DISPOSED OF AS PER THE BIO-MEDICAL WASTE (MANAGEMENT AND HANDLING) RULES 1998.

3.16.1 Composting options

All local bodies shall arrange for the composting of all bio-degradable waste by following any process of composting of waste found suitable under local conditions. Various methods of centralised and decentralised aerobic composting are being used in a big or small way in various parts of the country. These are briefly described in **Annexure F**. The committee recommends the use of decentralised processes of composting to reduce the cost of transportation, manpower and machinery wherever convenient and to the extent possible, and suggests centralised aerobic composting, microbial and/or vermi-composting for treatment of the organic component of the rest of the municipal solid waste.

3.16.2 Microbial Composting

Aerobic microbial composting is a well-known process and considerable experience is available in India. This process can handle mixed waste in any form and quantity. However, all efforts shall be made to segregate the organic matter at source and bring the same to the composting site. Learning from past experience, it is important to keep the level of mechanisation and the production cost to the minimum and to produce a good quality of compost free from heavy metals, sharps, glass etc. so that it can find a ready market.

The simple process of microbial composting is given in **Annexure G** along with a few photographs showing the process of centralised composting through a mechanical process.

3.16.3 Vermi-composting

In this process, earthworms are used for converting the organic waste into compost (vermi-castings). This process necessitates use of segregated organic waste and carefully weeding out of toxic material etc., This process also requires management of earthworms. This process has been successfully used in a limited scale upto 80 MT per day in Bangalore, Pune, Mumbai etc. but there is no large-scale centralised plant experience in India. This technology therefore, has a good potential in the cities where decentralised disposal is possible. The process of vermi composting is briefly explained in **Annexure H**. A photograph of neighbourhood vermi-composting is shown below.



Photo-40 : Neighbourhood vermi-composting of waste through an NGO effort.

3.16.4 Identification and Possession of Land for Waste Processing and Disposal

The processing and disposal of waste is one of the most important aspects of integrated waste management, as unscientific disposal of waste can cause irreparable damage to the environment and to subsoil strata and human health and life. No local body should therefore allow any dumping of domestic waste at unauthorised sites. Suitable waste processing and disposal sites must therefore be urgently identified and earmarked.

In many cities adequate land is not available for the disposal of waste. Several municipal bodies are therefore disposing of the waste on the roadside or elsewhere in a haphazard manner at the will of the transport staff. It is necessary to ban such dumping of waste and immediately and urgently identify and obtain suitable land for processing and disposal of waste in an environmentally acceptable manner.

Each local body should find adequate land for processing and disposal of waste, keeping in view the requirements of the city for at least the next 20-25 years. Depending upon the quantity of waste to be processed and disposed of annually, the requirement of land may be worked out and acquired accordingly. (2 hectares land per 100 tons/day waste for containerised composting and 200 cubic meters land per day, per 100 tons/day for landfilling the rejects may be the requirement, depending however on the technology selected.)

It is recommended that in cities where an adequate site, which may last for at least 10 years more, is not available, a committee may be formed, with the District Collector/ Deputy Commissioner, Municipal Commissioner/ Chief Executive/ Chief Officer, and the person in-charge of Solid Waste Management Department as members, to identify suitable land and recommend to the State Government or the authority concerned for allotment of such land, if that land be a government land or otherwise acquired.

To expedite land allotment and finalise the modalities of such allotment, State Governments may appoint an Empowered Committee, preferably headed by the Secretary, Revenue Department with Secretary Environment, Secretary Finance, Secretary Urban Development as members of the Empowered Committee, to give final rapid clearance to the allotment of land for the above purpose. Allotment should be free of cost or on a long term lease on a token lease rent or given to the local body for composting and disposal of waste with the land reverting back to government when the same is reclaimed after disposal of waste. The allotment of land for the composting site shall have to be for a very long term as it is required for permanent use and for the landfilling of rejects until the land is finally re-claimed .

The decision of allotment of land and handing over possession to the ULB should be ensured by such Empowered Committee within six months from the date of receiving the proposal.

In cases where the land identified happens to be private land, acquisition proceedings, under the urgency clause, may be initiated without any loss of time and necessary approval for allotment or for initiating acquisition proceedings should be given by the concerned Administrative Department of the State Government within six months from the date of submission of such proposal to the State Government, or such land may be purchased by the local body through negotiated settlement.

The landfill site for the rejects should preferably be the same parcel of land as the composting site, or very nearby, to minimise the cost of handling, transporting and landfilling the rejects.

The local body, while looking for lands, should identify preferably unproductive land that may be available within a range of 5 km. from the city boundary and at least 0.5 km. away from local habitation clusters. To keep the transport cost low, the Committee may consider acquisition/purchase of private land if municipal or Government land is not available within a reasonable distance. While selecting the site the distance from the airport should be maintained as per the Civil Aviation Regulations.

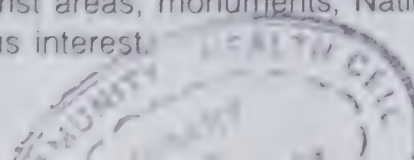
EARMARKING OF LOCATIONS FOR DIFFERENT USE OF LAND

While looking for sites for processing and disposal of waste the local bodies must identify suitable locations for:-

1. Weighbridge
2. Composting area
3. Site for the disposal of rejects
4. Making a secured landfill for the disposal of items like batteries, and domestic hazardous waste listed in Annexure-E, following the directions of Central or State Pollution Control Boards.

3.16.5 Site Selection

- a) The waste processing and disposal site should be large enough to last for 20-25 years, and preferably within 5 km from present city limits.
- b) It should be at least 0.5 km away from habitation clusters, tourist areas, monuments, National Parks, wetlands and places of important cultural, historical or religious interest.



- c) It should be 3 meters above the local ground-water level wherever possible, failing which the site level may need to be raised.
- d) 10 km away from the airport including the air base in the direction of funnel and 3 km away in other directions.
- e) It should not lie in the path of proposed highway or railway alignments.

3.16.6 Buffer Zone

As cities grow outward, once-suitable waste processing and disposal sites can get engulfed in new habitation, planned or otherwise. Hence it is vital for a 500-meter-wide Buffer Zone of No-Development to be declared in the Town Planning Department's land-use plans, to prevent objections by future neighbours, often through the Courts, in later years before the site life is exhausted.

Where a "green belt" restricting urban development has already been declared around mega-cities, this can serve the purpose of a Buffer Zone for a site within the green belt.

Waste Processing and Disposal Sites and their Buffer Zones must not be re-Zoned unless and until suitable alternate long-term sites have been identified and handed over to the ULB for use.

The 'No-Development' status of Survey Numbers within this buffer zone must be entered on local land records or Property Registers of surrounding towns, to alert persons considering the purchase of unauthorised house sites in such areas.

3.16.7 Development of Site

- a) The waste processing and disposal site must be fenced/hedged and provided with a gate to prevent unauthorised entry.
- b) A mechanical or computerised weigh-bridge shall be installed for monitoring the quantities of waste being carried by waste-transport vehicles to the site (as shown in photograph).

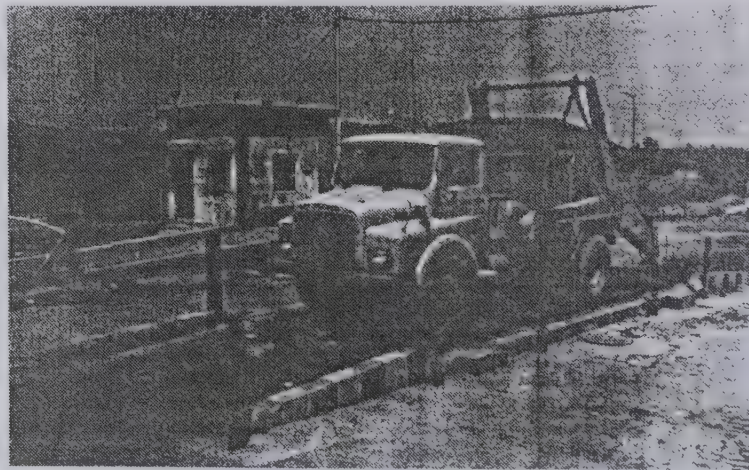


Photo – 41 : A computerised weigh-bridge being utilised to monitor waste brought to the processing and disposal site.

- c) Approach roads leading to the site should be made or improved, and maintained appropriately by the ULB.
- d) All-weather internal roads must be made, to facilitate easy movement of vehicles and tipping of waste at site during monsoon months also.
- e) Toilets should be constructed to prevent open defecation, and a small store-room constructed to store the required tools and equipment on-site.
- f) Arrangements must be made to provide safe drinking water at the site and to extinguish accidental fires.
- g) No bore-well should be drilled on-site for extraction of drinking water.
- h) Trees must be grown on or around the site to create a green belt to control dust and flying waste, improve environmental conditions and screen the site from public view.

3.16.8 Landfill Operation

- a) Compost-yard rejects and non-biodegradables may be brought to the landfill site for disposal according to standard work practices.
- b) Waste should be spread in thin layers and preferably compacted to achieve a high density of waste.
- c) In bigger cities where large quantities of waste are to be handled, bulldozers may be used on a daily basis for spreading and compacting of such waste and covering it with inert material.
- d) Small cities which cannot afford to have a bulldozer may spread waste manually, and cover it with inert material daily. They may compact the waste once in a week.
- e) The waste may be covered on a daily basis with a 7.5 cm. to 10 cm thick layer of inert materials such as construction waste or soil to avoid any foul smell and breeding of rodents and insects.
- f) To minimise erosion of the final cover, plantation or a vegetation cover may be made to sustain native plant growth.
- g) Rain water flow into the landfill area should be prevented.
- h) Run-off from landfilled areas should not enter any well or water body.
- i) Cities above 10 lakh population must regularly monitor nearby water quality.
- j) Public gardens with land-scaping may be developed in stages on the landfill in such a manner that stagnation of rainwater does not take place and rainwater runs off the site.
- k) Waste should not be allowed to be burnt at the waste processing or disposal site to avoid air-pollution.
- l) Records may be maintained of date, time and quantity of waste received at site and the number of trips made by each transport vehicle.
- m) After completion of landfill, a minimum final raised cover of soil or construction waste of at least 30 cm shall be provided and maintained to ensure run-off of rain-water from the surface.

3.16.9 Closure of Landfill Site

Landfill sites after closure, shall have post-closure care for at least 15 years. Long term monitoring/care plans shall include:

- a. Maintaining the integrity and effectiveness of final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion or other events and to prevent rain-water run-on and run-off from eroding or otherwise damaging the final cover;
- b. Monitoring ground water in accordance with requirements and taking corrective measures as and when required;
- c. Monitoring of landfill gases to assess levels of methane, for ensuring compliance as per the prescribed standards;
- d. Planned use of closed landfill sites can commence after ensuring that the landfill gases, leachate and ground-water analysis permit such use.

3.16.10 Handling And Disposal Of Bio-Medical Waste

All small hospitals, nursing homes, laboratories, dispensaries and pathology laboratories regardless of size which are not statutorily covered by the Bio-medical Waste (Management & Handling) Rules 1998 should also try to follow the directions contained in the Rules and the instructions given by the Central Pollution Control Board and State Government Pollution Control Boards from time to time. The State Government and the Municipal Authorities should take the lead in setting up proper facilities for their own medical establishments. It should be ensured by the medical institutions that their Bio-medical waste does not get mixed with the municipal solid waste.

Municipal authorities should be declared as the Appropriate Authority in all Class I cities under the Bio-medical Waste (Management & Handling) Rules 1998.

Although hospitals, nursing homes, dispensaries, pathological laboratories and health care establishments are now required to manage and dispose of the bio-medical waste produced by them, as per the Rules, the local bodies may act as catalysts and may facilitate the creation on full-cost-recovery basis of common facilities for hospitals, nursing homes and health care establishments to ensure compliance with the Rules. The cost recovery should include maintenance, repairs, depreciation and replacement of the common facilities besides O & M cost. The collection, transportation and disposal of hospital waste can be privatised by the association of such waste producers if considered necessary, but that should be done under the active supervision and control of the local body. It should be made compulsory for the hospitals and nursing homes to avail of the common facility if they do not have their own treatment facilities to the satisfaction of the municipal authorities & SPCBs. All the hospitals, nursing homes etc. should be registered with the local body and obtain from the Health Officer of the local body a certificate of satisfactory arrangement having been made for the disposal of Biomedical waste. The charges for the collection, transport and disposal of biomedical waste should preferably be fixed on a per-bed-per-day basis and on an approximate-weight basis for other establishments where there are no beds.

3.16.11 Disposal Of Slaughter-house Waste And Carcasses Of Dead Animals Sec. 3.16.11

The disposal of slaughter house waste and carcasses of dead animals should be done scientifically following the guidelines of the Central Pollution Control Board as may be finalised and amended from time to time. This waste should not be mixed with municipal waste. This waste should wherever possible be converted into a useful product by installing a carcass-utilisation plant with financial support from the Government of India's Ministry of Agriculture and Animal Husbandry.

3.16.12 Disposal Of Industrial Waste

Industrial waste is required to be stored, transported and disposed of by industries as per the guidelines of the respective State Pollution Control Boards. However, the State Governments and local bodies may act as catalysts by helping industries to procure land, and in the transportation and disposal of non-hazardous industrial waste on a full-cost-recovery basis.

3.16.13. Common Treatment And Disposal Facilities

In the cities where availability of land is very scarce for setting up a treatment plant or a disposal site or where setting up a plant for a small city is not economically viable, common facilities for waste treatment and disposal may be created on pro-rata cost-sharing basis between cities and towns.

3.16.14. Closure Of Old Disposal Sites

Old waste disposal sites lying abandoned in and around the cities cause problems of health and environment. Local bodies should therefore take immediate measures to spread and compact the garbage and cover it with a thirty centimeter thick layer of inert waste material such as construction waste and make a convex surface on the top to promote run-off of rain water. The local body should also make arrangements to prevent entry of rain water from outside into the landfill by providing catch water drains on the periphery of the dump site. On the lower side of the dump site, a leachate collection drain, a sump and a pump may be provided to drain off the leachate. This leachate can be sprayed back onto the landfill from time to time.

3.16.15. "NIMBY SYNDROME"

The ULBs have been facing litigations from time to time against the continuance of the existing waste treatment and disposal sites. In such cases the local body should make efforts to improve the site operations if there is some problem and resist any moves for its closure.

3.16.16 Marketing Mechanism For The Sale Of Compost

Once conversion of urban bio-degradable waste is made compulsory, finding a steady market for so much compost will pose an urgent and serious challenge for all compost producers. For this reason alone, compost plants are best left to the private sector. However, local bodies can and should help by using compost from their city waste within their own city, in parks and gardens, road dividers and islands, avenue trees and nurseries etc.

The Ministry of Agriculture of the Government of India and the departments of agriculture of the various State Governments should play a very vital role in propagating use of compost along with chemical fertilizer, highlighting the benefits of the use of compost to the farmers, send the message down the line through their extension workers in each village and link the marketing of compost with the marketing of chemical fertilizers in the districts and villages. Marketing Federations will have to be involved in this work. Government of India and State Governments should initially support the sale of compost on par with chemical fertilizer.

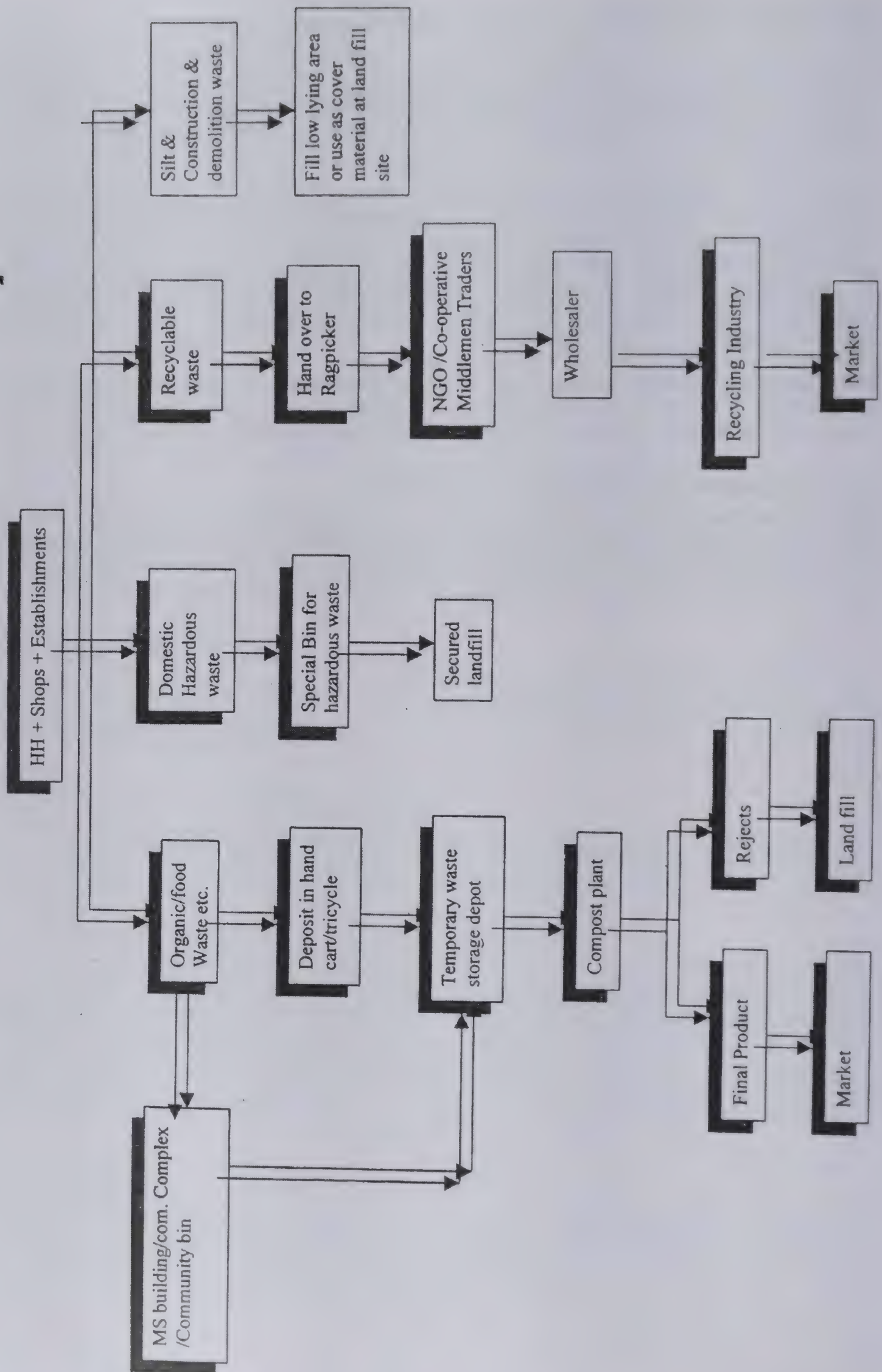
Saline and alkaline land reclamation and wasteland development programs should be linked with programs for marketing of compost, as such lands can be effectively restored by continued use of compost. These efforts may be supported by providing compost initially at reduced or supported rates.

3.16.17 Demonstration Farming Using Compost

Departments of Agriculture of various States should promote the use of compost by having demonstration farming using compost in appropriate proportions and publicise the results widely to increase acceptance of the use of compost by the farming community. Government of India may also consider giving subsidies in the sale of compost just as it is supporting the chemical fertilizer industry.

Flowchart of Municipal Solid Waste

56



CHAPTER 4

INSTITUTIONAL ASPECTS & CAPACITY BUILDING

The subject of solid waste management has remained neglected for the past several decades, with the result that the level of service is highly inadequate and inefficient. For improving the solid waste management services it is essential to adopt modern methods of waste management and have a proper choice of technology which can work in the given area successfully. Simultaneously, measures must be taken for institutional strengthening and internal capacity building, so that the efforts made can be sustained over a period of time and the system put in place can be well managed. Institutional strengthening can be done by adequately decentralising the administration, delegating adequate powers at the decentralised level, by inducting professionals into the administration and providing adequate training to the existing staff. It will also be necessary to fix work norms for the work force as well as for supervisory staff and the output expected from the vehicles and machinery utilised. NGO/private sector participation also needs to be encouraged to make the service competitive and efficient.

MANDATORY RECOMMENDATIONS

THE LOCAL BODY SHALL TAKE ADEQUATE MEASURES FOR INSTITUTIONAL STRENGTHENING THROUGH INDUCTION OF PROFESSIONALS, DECENTRALISATION OF ADMINISTRATION, DELEGATION OF POWERS, HUMAN RESOURCES DEVELOPMENT, PRIVATE SECTOR AND NGO PARTICIPATION.

This may be done as under:

4.1 DECENTRALISATION OF ADMINISTRATION

In large cities the SWM services can be performed effectively only if its administration is adequately decentralised. Decentralisation can be at least 3-tiered —one at the Ward level, second at the Zone level and third at the city level.

The SWM functions would get focussed attention if all functions of the city administration are decentralised at Zone / Division levels and senior officers are placed incharge of each Zone / Division, functioning independently with adequate delegated powers.

The SWM functions are proposed to be decentralised as under:

4.1.1 Ward level administration

The ward level administration should be fully responsible for ensuring storage of segregated waste at source, primary collection of waste, street sweeping and taking the waste to bulk community waste storage sites, clearing debris and cleaning surface drains and public spaces. The cleaning of each street, lane, by-lane, market and public space should be regularly supervised by the ward-level supervisors. The presence of all SWM officers of the Ward in the field during morning hours is most essential. A grievance redressal system should be put in place in each ward.

Involvement of Ward Committees:-

The 74th Constitutional Amendment envisages formation of Ward Committees in each city above 3 lakh population. These Ward Committees, as and when formed, may be very profitably involved in improving SWM services at the Ward level. These Committees could be motivated to help in the following areas:-

1. Creating public awareness at the Ward level;
2. Formation of Residents Association/ Neighbourhood Committees to ensure public participation in source segregation of recyclable waste and deposition of domestic waste in the handcarts on time during primary collection;

3. Involving school children to be watch dogs in preventing littering of streets by the people,
4. Interfacing with the people and officials and helping in redressal of public grievances on SWM at the ward level;
5. Supporting the effort of cost recovery for the services rendered;
6. Encouraging NGO participation;

4.1.2 Zonal Administration

Administrative Zones should be made for a group of wards. Each Zone can cover a population of about 5 lakh people.

The Zonal administration should effectively supervise and support the work of the Ward administration and also provide Zonal level support such as construction and upkeep of flooring below communal waste storage sites, transportation of waste from the communal storage sites to the transfer station, processing plant and disposal sites. If the Zones are not allotted adequate vehicles for the transportation of waste due to paucity of vehicles, the transportation of waste may be coordinated centrally for optimum utilisation of the fleet of vehicles in 2 or 3 shifts.

4.1.3 City Level Administration

The city level administration should supervise and support the Zonal administration and in cases where the fleet of vehicles is not decentralised at the zonal level, the central SWM Department should look after the transportation of waste from the waste storage sites on a daily basis. The Central SWM Department should be responsible for the construction and upkeep of the vehicles, transfer stations, setting up and maintenance of processing plants, incineration plants as well as for managing the disposal sites in an environmentally acceptable manner.

The central SWM department should also be responsible for the procurement of vehicles, equipment, and land for processing and disposal of waste. As a Head Office it should take policy decisions and co-ordinate the activities of all zones and wards and be answerable to the Chief Executive and elected body for the efficient functioning of the department. It should look after the recruitment of manpower, human resources development, training etc.

4.2 DELEGATION OF POWERS

Authority and responsibility should go hand in hand. For fixing accountability, there should be adequate delegation of fiscal and disciplinary powers to the officers and the supervisory staff responsible for managing solid waste and carrying out all day-to-day functions smoothly.

The Head of the SWM department should also have the power to punish subordinates including supervisory staff. Adequate in-built checks may be introduced to ensure that the delegated powers are not misused.

4.3 Induction Of Environmental/Public Health Engineers

The subject of solid waste management, so far being handled by Health Officers (who are medical doctors) in most cities, now needs to be handled by environmental engineers or public health engineers with the support of mechanical/automobile engineers to handle the workshop facilities. Qualified engineers should, therefore, be regularly inducted in cities above 100,000 population. The following yardstick could be followed for the induction of professionals in the solid waste management services:

1 Cities between 1 and 2 lakhs population

- i. Public Health/Environmental Engineer or Civil Engineer having training in environmental/public health engineering in the grade of Asst. Engineer, to be in charge of SWM department,
- ii. Qualified Sanitation Diploma holder/Sanitation Officer @ 1 S.O. per 1 lakh population or part thereof to look after the collection, transportation, processing and disposal of waste or @ 1 per 2 Sanitary inspectors, whichever is less.
- iii. Qualified Sanitation Diploma holder / Sanitary inspector @ 1 S.I. per 50,000 population or part thereof or @ 1 per 120 sweepers, whichever is less.
- iv. Qualified Sanitation Diploma holder / Sanitary Sub-inspector (S.S.I.) @ 1 S.S.I. per 25,000 population or part thereof or @ 1 per 40 sweepers, whichever is less.
- v. Sanitary Supervisors (Mukadams who can read, write and report) @ 1 S. S. per 12,500 population or part thereof, or 1 per 20 sweepers, whichever is less.

2 Cities having populations between 2 to 5 lakhs

- i. Public Health/Environmental Engineer in the Grade of Asst. Executive Engineer to be in charge of SWM department.
- ii. Public Health/Environmental Engineer in the grade of Asst. Engineer to look after the transportation, processing and disposal of waste.
- iii. Sanitary Officers @ one S.O. per 1 lakh population for supervising the storage, segregation, street sweeping and primary collection of waste.
- iv. Sanitary Inspectors, Sanitary Sub-inspectors, Sanitary Supervisors should be as per the yardstick indicated in 1 above.

3 Cities having population between 5 to 20 lakhs

- i. Public Health/Environmental Engineer of the level of Executive Engineer to be in-charge of the SWM department
- ii. Public Health/Environmental Engineers of the level of Asst. Executive Engineer 1 per 5 lakhs population.
- iii. Public Health/Environmental Engineers of the level of Asst. Engineer 1 per 2.5 lakhs population.

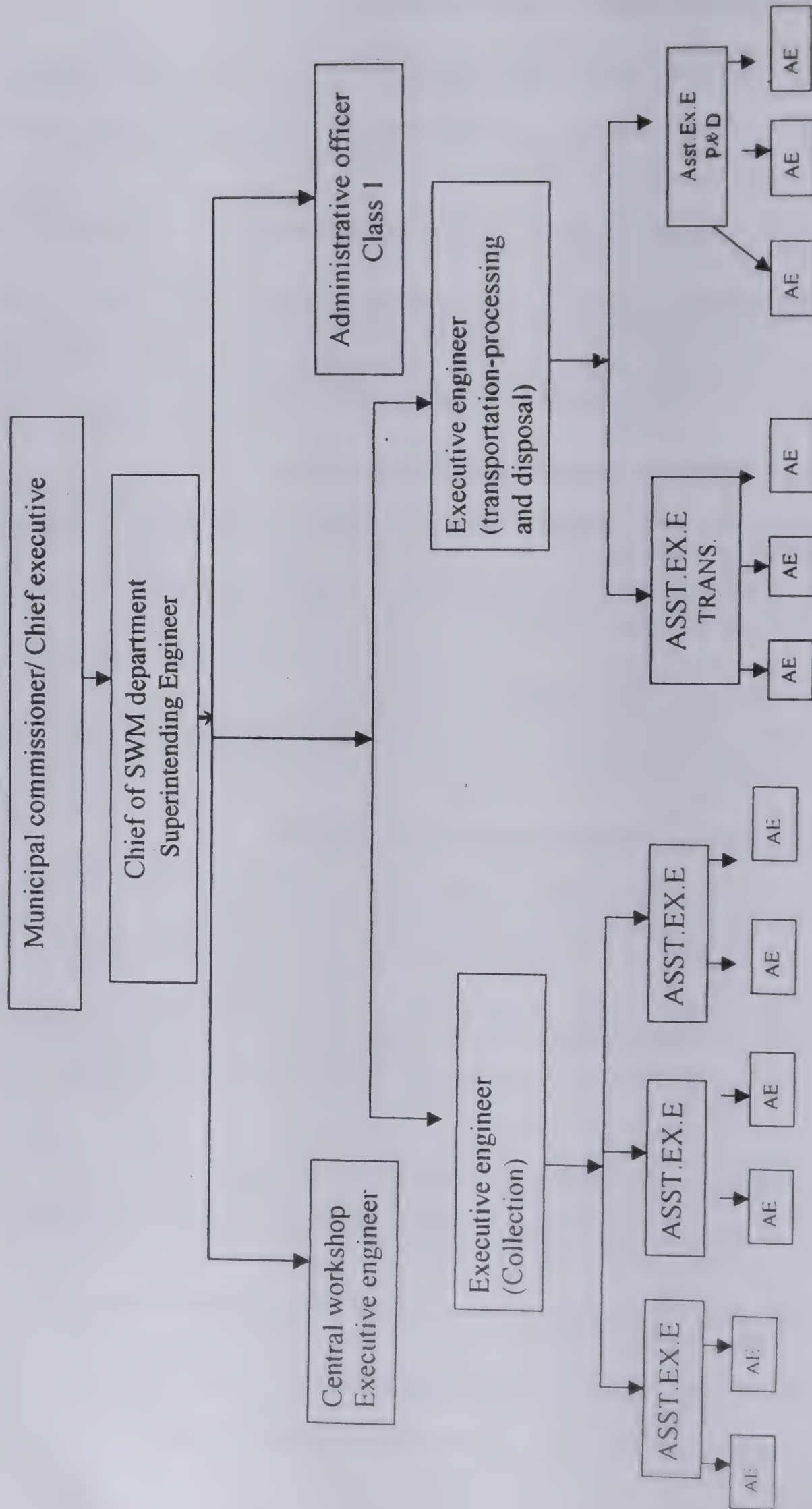
Sanitary Officers, Sanitary Inspectors, Sanitary Sub-inspectors and Sanitary Supervisors as per yardstick indicated in 1 above.

4 Cities having Populations between 20 and 50 lakhs

- i. Public Health Engineer/Environmental Engineer of the level of Superintending Engineer to be the Head of SWM Department.
- ii. Public Health/Environmental Engineers of the level of Executive Engineer @ 1 Ex. Eng. per 20 lakhs population or part thereof.
- iii. Rest of the supervisors and staff as per the yardstick already indicated in 1 to 3 above.

A typical organisation chart for a city of 30 lakhs population is shown below.

TYPICAL ORGANISATION CHART FOR A CITY OF 30 LACS POPULATION



See Next Page for Explanation

STAFFING AND QUALIFICATION NORMS FOR DIFFERENT SIZES OF CITIES

City Population	1 Lac	2 Lac	5 Lac	20 Lac	40 Lac	Over 40 Lac
SWM Supervisory Cadre						
C.E. = Chief Engineer to be a Public Health / Environmental Engineer in Charge of SWM Dept. in cities above 50 lac population	--	--	--	--	--	1
S.E. = Superintending Engineer to be a Public Health / Environmental Engineer of cities above 20 lac @ (1 per 40 lac pop or part)	--	--	--	1	1	1+
E.E. = Executive Engineer to be a Public Health / Environmental Engineer in cities above 20 lac @ (1 per 20 lac pop or part)	--	--	1	1	2	2+
A.E.E. = Asst. Exec. Engineer to be a Public Health / Environmental Engineer in cities above 2 lac population @ (1 per 5 lac pop or part)	--	1	1	4	8	8+
A.E. = Asst. Engineer to be a Public Health / Environmental Engineer in cities above 1 lac population @ (1 per 2.5 lac pop or part)	1	1	2	8	16	16+
S.O. = Sanitary Officer to have Sanitation Diploma (1 per 1 lac pop)	1	2	5	20	40	40+
S.I. = Sanitary Inspector to have Sanitation Diploma (1 per 50,000 pop or 1 per 120 sweepers whichever is less) (1 per 2 SSI)	2	4	10	40	80	80+
S.S.I. = Sanitary Sub-Inspector, a diploma holder in Sanitation (1 for 25,000 pop or 1 per 40 Sweepers, whichever is less (Or per 2 SS)	4	8	20	60	80	160+
Sanitary Supervisor (Mukadam or Jamadar or Maistry who is literate) (1 for 12,500 pop or 1 per 20 sweepers, whichever is less)	8	16	40	160	320	320+
Sweepers as per norms (para 3.8)						

5 Cities above 50 lakhs population

- i Public Health Engineer/Environmental Engineer of the level of Chief Engineer to be in charge of the SWM department.
- ii Superintending Engineer per 40 lakhs population or part thereof.

Rest of the officers, supervisors etc. as per yardsticks already indicated in 1 to 4 above.

Note: In cities where health officers are looking after SWM or part thereof, in addition to their principal function of taking preventive health measures, they may be gradually made free from this responsibility and replaced by environmental or public health engineers.

4.4 HUMAN RESOURCE DEVELOPMENT

Human resource development is very essential for the internal capacity building for any organisation. Training, motivation, incentives for outstanding service and disincentives for those who fail to perform are essential for human resource development.

Concerted efforts should be made by the local body to inculcate among its officers and staff a sense of pride in the work they do, to motivate them to perform and give their optimum output to improve the level of services of the city and the image of the local body.

1. Training :

Special Training To Unqualified Staff

Unqualified supervisory staff should be given in-service training to qualify for supervising sanitation works.

Refresher Courses For Supervisory Staff

Refresher courses should be conducted for the supervisory staff at least every 5 years, or they should be sent for training to get an exposure, to advance in this field.

Exposure to Municipal Commissioner/ Chief Executives

It is necessary to give an orientation to the Chief Executive of the local body and make them aware of this important aspect of Urban Management. They may therefore be given exposure to SWM through short training programs.

Design SWM Courses

SWM courses may be designed for Engineers and applied science disciplines.

2 Promotional Opportunities

Adequate promotional opportunities should be available in the decentralised SWM hierarchy to maintain the interest of the supervisory staff to remain in the department.

4.5 WORK NORMS

Norms of work for street sweepers

The sweepers may be assigned "Pin point" individual work assignments according to the density of the area to be swept. The yardsticks given in para 3.7 can be adopted.

Similarly work norms can be prescribed for a variety of vehicles used depending upon the distance to be traveled and the places to be covered. These norms may be prescribed after conducting time and motion study.

The norms of work for the supervisors may also be prescribed and monitored by the local body, for the extent of sweeping areas and the number of garbage collection points to be inspected each day by the various levels of supervisors and inspection of processing and disposal sites etc. to ensure adequate output of the supervisory staff.

All Supervisory Officers right from Sanitary Inspector to Health Officer/Chief Engineer in-charge of SWM department must remain on the field for 4 hours in the morning between the time of street sweeping and lunch break. The timings for the middle level supervisor could be from 7.00 a.m to 11.00 a.m and for senior levels from 8.00 a.m to 12.00 noon or 8.30 to 12.30 in the morning and again from 2.30 to 5.30 p.m or 3.00 to 6.00 p.m in the evening whenever required. This supervision will have a direct impact on the quality of service.

For capacity building of the department, senior officials should be frequently exposed to developments taking place in various parts of the State and country by sending them out on city visits and to attend seminars, workshops and training courses. They should also be involved in all decision making processes.

4.6 The entire administration of SWM Department to be under One Umbrella

To avoid the problem of lack of coordination and passing off of responsibility to others, it is necessary to have one person exclusively in charge of SWM in the city. The overall control in relation to the collection, transportation, processing and disposal of all waste, including vehicle workshop facilities, should lie with him. He should also be responsible for the cleaning of open drains under 24" depth, collection of silt, construction waste and debris and vehicle deployment and maintenance. This work should not be left to the Engineering Department, which should however continue to be responsible for the removal and transportation of silt from the underground drains, storm water drains or surface drains exceeding 24" depth, and the left over waste material from their Engineering and major road works.

4.7 Safeguarding supervisory staff of the Sanitary Department against abuse of the Scheduled Caste Scheduled Tribes (Prevention of Atrocities) Act, 1989

The work of city cleaning and disposal of waste is generally handled by a particular community from among the Scheduled Castes. There is a provision in the above Act that if any person causes harassment to or insults a person belonging to the sweeper community, a complaint can be filed against him and he could be arrested without warrant. This provision of law is at times being misused by the sweepers and they hold out a threat to the supervisory staff of action under the above Act if any disciplinary action is to be taken against them.

The supervisory staff of the Sanitation Department has to work day-in and day-out with the sweepers. They necessarily have to take action against those who do not perform satisfactory work. With a view to ensure that the supervisory staff can take work from the sweepers effectively and fearlessly, it is necessary to protect them adequately against misuse of the law. Hence action under the above Act should be allowed only if the Head of the Department is satisfied that any such offence has been committed by the supervisory staff. The Act may require amendment accordingly.

4.8 The tenure of the Municipal Commissioner & Chief Executive Officers

It is observed that in several States the Municipal Commissioners or Chief Executive Officers are transferred very frequently and often their tenure is found to be less than 6 months. Managing cities and tackling urban problems is a speciality in itself and a person can give justice to his assignment only if he is left undisturbed on a particular post for a reasonable period of time. It takes about 6 months just to understand the complexities of urban governance before one can begin to improve the system and think of perspective planning and development of the city. This is only possible if the incumbent has a reasonable expectation of staying in that position for about 3 years. In an atmosphere of frequent transfers, no long-term development is planned and the city suffers. It is, therefore, recommended that unless there are grave charges against the officer, the Municipal Commissioners or Chief Executives should, to the extent possible, be continued in office for a period of 3 years and then made fully accountable for their performance.

4.9 INTER-DEPARTMENTAL CO-ORDINATION

Since the SWM department depends greatly upon the support of various departments of the local body, more particularly the Engineering Department, the Chief Executive of the local body should hold regular monthly co-ordination meetings to sort out problems faced by the SWM department such as expeditious repairs of roads, drains, water-supply pipe-lines etc. which cause hindrance to street and city cleaning. The reinstatement of roads dug up by utility services should also be given priority.

The procurement procedures for the SWM equipment also need to be expedited and simplified in such meetings. A Rate-contract system should replace time consuming tendering procedures.

There should be an Apex Committee comprised of representatives of various utility services, headed by the Chief Executive of the local body, to co-ordinate the laying of underground services in the city by various utilities and the reinstatement of the roads as soon as the underground services are laid. The Apex Committee should ensure that repeated digging of roads is avoided for laying of services by various utilities. The works to be carried out by various utilities on a particular road should be coordinated, to prevent frequent digging of roads.

Laying and maintaining of services in slums, provision of public health engineering services and water supply for public toilets and road construction in the slums to improve overall health and sanitation in the city may also be regularly reviewed in the co-ordination committee meetings.

4.10. ENCOURAGEMENT TO NGOS AND WASTE COLLECTOR CO-OPERATIVES

NGOs may fully involved in creating public awareness and encouraging public participation in SWM planning and practice.

The local body may also encourage NGOs or co-operatives of rag pickers to enter this field, organise rag pickers in doorstep collection of waste and provide them an opportunity to improve their working conditions and income. The local body can give incentives to NGOs in their effort of organising rag pickers in primary collection of recyclable and/or organic waste, and provide financial and logistic support to the extent possible.

4.11 NGO/PRIVATE SECTOR PARTICIPATION

SWM services are highly labour intensive. On account of the increased wage structure of the Government and municipal employees, this service is becoming more and more expensive. Besides, the efficiency of the labour force employed in the urban local bodies is far from satisfactory. High wage structure and inefficiency of the work force results a steep rise in the cost of service, yet the people at large are not satisfied with the level of service being provided by the urban local bodies. Efforts to increase the efficiency by H.R.D. and institutional strengthening will, to some extent, improve the performance but they may not be enough. It is, therefore, necessary that the local bodies seriously consider NGO/private sector participation in solid waste management.

Private sector participation or public private partnerships may be considered by urban local bodies keeping in mind the provisions of the Contract Labour (Regulation and Abolition) Act 1970 of the Government of India, which does not permit contracting out the services already being provided by the urban local bodies. Therefore, while considering any measure of privatisation it is necessary to keep in mind the provisions of the above law and consider private sector participation in those areas where Municipal Corporations or municipalities are not currently providing a service. This will check growth in the establishment costs, bring in economy in expenditure and introduce an element of healthy competition between the private sector and the public sector in solid waste management services. There should be a right mix of private sector and public sector participation to ensure that there is no exploitation of labour as well as of the management.

NGO/private sector participation can, therefore, be considered in newly developed areas, under-served areas and particularly in areas where local bodies have not been providing service. Some examples are given below:

NGO/private participation should be encouraged in the areas of door to door collection of domestic waste, door to door collection of commercial waste, door to door collection of hospital waste, hotel waste, construction waste, and yard waste, and in the area of awareness and creating public participation. The private sector may also be encouraged to set up, operate and maintain compost plants and other treatment plants and common disposal facilities. Supplying vehicles on rent, supplying vehicles on lease, repairs and maintenance of vehicles at private garages are also some areas where the private sector can be involved.

4.12 INCENTIVES TO THE PRIVATE SECTOR

Solid waste management, processing and disposal is an area where the private sector has still not shown much interest. The private sector has, therefore, to be given some incentives by way of long-term contracts, assured supply of garbage at the plant site, lease of land at nominal rates for entering this field.

NGO as well as Private sector participation may be encouraged in such a way that it does not affect the interests of the existing labour, it does not violate the provisions of the above law, does not exploit the private labour and yet reduces the burden of the urban local body. This will substantially help in improving the quality of service of the urban local bodies, effect economy in expenditure and also give scope to the private sector to enter the waste management market.

4.13 Amendment to Contract Labour (Regulation and Abolition) Act 1970

The Contract Labour (Regulation and Abolition) Act 1970 of the Government of India prohibits contracting out of any service which is being provided by the ULB through its own staff. In view of the felt need to encourage private sector participation in SWM services for the reasons explained in paragraph 4.11 above, it is recommended that the Government of India may consider suitable amendments to the aforesaid Act to facilitate NGOs and private sector participation in Solid Waste Management services in urban area.

4.14 LEVY OF ADMINISTRATIVE CHARGES

With a view to ensure adherence to the instructions given by the civic body to the citizens and making them aware of their civic responsibility of not littering the street and throwing the solid waste anywhere on the streets or open spaces, it is recommended that provision should be made in the relevant by-laws, rules etc to recover Additional Cleaning Charges from the citizens who dispose of waste on the street or in open public places necessitating the cleaning of the road again by the local body. The power to levy such charges should be delegated to the supervisors of the level of Sanitary Inspectors and above. The amount of additional cleaning charges to be levied should be specified for different categories of offenders and should be kept higher for repeat offences.

4.15 MOBILE SANITATION COURTS

It is the tendency of the public to take their civic responsibilities lightly. It is therefore necessary that while on one hand people are motivated to participate effectively in keeping the cities clean, there should be a fear of punishment if they fail to discharge their civic obligation. Provision of Mobile Sanitation Courts is therefore recommended in 1 million plus cities to punish on the spot the offenders violating the sanitation laws and civic instructions for keeping the cities clean.

4.16 Role of Technology/Educational & Research Institutions

1. The technology institutions like Engineering Institutions & Research Organisations may be encouraged to take up work in SWM sector. This will also indigenise SWM processing technology. Ministry of Human Resource Development may provide them means to achieve this objective.
2. Solid waste has many components which have positive physical and chemical properties and with proper blending and processing can be used to create new and useful products. In view of the depleting natural resources above technology institutions may look into these aspects also.

4.17 Documentation of best practices

It is seen that good practices are seldom documented. This may be arranged from time to time by the Ministry of Urban Development in order to have development through spread effect.

CHAPTER 5

MANAGEMENT INFORMATION SYSTEMS

Good management is the key to keeping a city clean. This requires collection of critical information – not just for keeping the records up-to-date but also for taking corrective measures and for proper planning for the future. Some information is, therefore, required to be collected to have an overall idea of the prevalent situation, deficiencies in the system and likely requirements for the future. Day-to-day deficiencies in the system should also be regularly monitored to enable corrective measures. Computerisation of such information helps all the levels to work not only harder but also smarter. In this way, it increases job satisfaction over time.

With the advancement of information technology, Geographic Information System (GIS) could be introduced in large cities. MIS may be integrated in this system. Similarly, there is a need for a citizen interface to seek comments, suggestions, etc. on utility services.

Municipal SWM departments need relevant information for their planning processes. They also need specific information to know whether every one involved in SWM services is performing well, adequate vehicles are being given to the SWM Dept. by the workshop, the vehicles give their optimum output, the repairing and maintenance of vehicles and equipment at the workshop is properly done, the vehicles carrying the waste to the disposal site are optimally utilised, the processing plants are performing well, landfill sites are well managed, etc.

First thing each morning, the chief executive of the SWM department should check the data to see whether anything unusual or unsatisfactory has happened that needs immediate remedial measures. A list of items is given below on which the data should be collected and kept on record for planning purposes. A few *pro-formas* are provided (as under) for monitoring the activities of various sections of the SWM department. These *pro-formas* may be utilised by the local bodies with suitable modifications.

GENERAL INFORMATION TO BE COLLECTED AND UPDATED FROM TIME TO TIME

1. Area of the city
2. Population of the city
3. Decadal growth of population
4. Number of wards, their area and population
5. Ward-wise information in regard to :
 - Population density in different wards;
 - Number of households, shops and establishments
 - Vegetable/fruit/meat/fish markets
 - Number of hotels & restaurants
 - Number of hospitals and nursing homes
 - Number of industries
 - Number of slum pockets and their population
 - Road length and width
 - Percentage of area covered by underground sewerage system
 - Percentage of area having surface drains
 - Percentage of area having no drainage facility
 - Total number of public toilets and toilet seats
 - Number of public urinals
 - Number of nuisance spots

GENERAL INFORMATION ON SWM

Waste-generation

1. Average quantity of waste produced each day
2. Seasonal variations in daily waste generation
3. Total quantity of waste produced annually during the last 3 years
4. Break-down of the quantity of waste generated, into sub-categories:
 - i. Household, shop and establishment waste
 - ii. Vegetable and food market waste
 - iii. Meat, fish and slaughter house waste
 - iv. Construction & demolition waste
 - v. Hospital waste
 - vi. Industrial waste
5. Average number of carcasses removed each day

Staff positions

- 6 Number of sanitation workers deployed in the city for the collection of waste
- 7 Number of sanitation workers deployed for the transportation of waste
- 8 Ward-wise allocation of sanitation workers
- 9 Sweeper/population ratio in each ward
- 10 Sweeper/road length ratio in each ward
- 11 Sweeper/supervisor ratio in each ward

Waste storage depots

- 12 Number of sites designated/notified for temporary disposal of waste (i.e. dust bins)
- 13 Type and size of dustbin provided in each ward
- 14 Ward-wise quantum of waste generated each day

Transportation

- 15 Number of vehicles provided by local body for transportation of waste; their type, size and age.
- 16 Number of trips made by each vehicle in one shift.
- 17 Number of vehicles used in each shift.
- 18 Quantity of waste transported in each shift.
- 19 Total quantity of waste transported each day.
- 20 Percentage of waste transported each day.

Waste processing and disposal

- 21 Number of waste processing and disposal sites in the city
- 22 Their distances from the centre of the city
- 23 The area of these sites
- 24 The quantity of waste treated/disposed of at each site
- 25 The expected life of each land-filled site

Financial aspects

- 26 Operating cost
 - a. Cost of collection per ton per day
 - b. Cost of transportation per ton per day
 - c. Cost of disposal per ton per day
- 27 Allocation of revenue and Capital budget for SWM vis a vis the City Corporation's budget.

MONITORING OF SWM SERVICES

For the day-to-day monitoring of SWM services, the following data may be collected, compiled and analysed.

DAILY REPORTS TO BE SENT

(1) Collection of waste

- i. Number of sweepers required to report for duty
- ii. Number of sweepers actually reporting for duty
- iii. Number of sweepers absent
- iv. Areas left unattended
- v. Arrangements made or proposed to be made for clearing the backlog

(2) Inspection by supervisors for street sweeping & primary collection

- i. Number of persons under each supervisor
- ii. Number of persons supervised during the day
- iii. Number of cases where performance is satisfactory
- iv. Number of cases where performance falls short
- v. Action taken or proposed to be taken
- vi. Complaints received and attended

(3) Inspection of cost-recovery services

(e.g. hotels, hospitals, commercial streets and offices)

- i. Number of cost-recovery sites under each supervisor's charge
- ii. Number of sites inspected
- iii. Deficiencies noticed
- iv. Complaints received and attended
- v. Action taken or proposed to be taken

(4) Inspection of bulk community waste storage sites

- i. Number of sites under each supervisor's charge
- ii. Number of sites inspected
- iii. Number of sites found well-maintained
- iv. Number of sites found ill-maintained or needing repair or replacement
- v. Action taken
- vi. Number of unauthorised waste disposal sites or sites identified during field visits
- vii. Action taken

(5) Inspection of silt-removal & building waste disposal sites

- i. Number of silt-removal sites inspected
- ii. Number of sites found satisfactory
- iii. Number of sites where silt was found lying outside the man-hole or surface drain
- iv. Number of construction sites/construction waste disposal sites visited
- v. Number of sites where construction waste was found disposed of unauthorisedly
- vi. Action taken

(6) Transportation of waste

- i. Number and type of vehicles and equipment required to report for duty
- ii. Number and type of vehicles and equipment which actually reported for duty
- iii. Breakdowns reported during the day and action taken
- iv. Number of trips made to the disposal site by each vehicle
- v. Number of bins cleared during the day
- vi. Number and locations of bins left uncleared and
- vii. Arrangements made or proposed to be made for clearing the backlog

(7) Quantities of waste transported

- i. Number of vehicles deployed during the day
- ii. Number of trips made
- iii. Quantity of waste transported
- iv. Number of vehicles which did not make adequate trips
- v. Number of vehicles which carried less garbage
- vi. Action taken or proposed to be taken against defaulters

WEEKLY REPORTS**(8) Inspection of processing sites**

- i. Whether the plant was functional during the week
- ii. Whether it received the garbage as prescribed regularly
- iii. Whether the site is properly maintained and waste stacked properly
- iv. Quantity of bio-organic fertilizer/desired material produced
- v. Quantity of produce sold during the week
- vi. Quantity of end product in stock
- vii. Any irregularity noticed
- viii. Action taken

(9) Inspection of waste disposal sites

- i. Name of the site inspected
- ii. Whether all the staff was present on duty during the week
- iii. Whether the required machinery was available on site on all the days
- iv. Whether the approach road and internal roads are properly made
- v. Whether the weighbridge is functional and properly used
- vi. Quantity of waste received at the site on the days during the week
- vii. Whether the entire waste was spread, compacted and covered on the same day
- viii. Whether communication facilities such as telephone, wireless etc. remained functional during the week
- ix. Whether shelter and drinking water facility is adequate
- x. Deficiencies noticed
- xi. Remedial action taken or proposed to be taken

(10) Record of trips made by transport vehicles at the processing and disposal sites

- i. Supervisor number
- ii. Date
- iii. Vehicle number
- iv. Name of the driver
- v. Arrival time of the vehicle
- vi. Trips made including this trip
- vii. Waste source and route number
- viii. Weight of waste in metric tonnes
- ix. Deficiencies noticed
- x. Action taken

(11) Workshop performance

- A.
 - i. Number and percentage of vehicles on road
 - ii. Number and type of vehicles under repair at Corporation's or private workshop
 - iii. Nature of breakdown
 - iv. Duration of breakdown : under one week, 1-2 weeks, 2-4 weeks and over one month
 - v. Reasons for delay in repairs
 - vi. Expected date of vehicle to be back on road
- B.
 - i. Number and type of vehicles and equipment to be given to the SWM Dept. by the workshop or contractor
 - ii. No and type of vehicles and equipment actually given
 - iii. Shortfall, if any
 - iv. Reasons
 - v. Alternate arrangements made
- C. Each vehicle should maintain a log book showing information of its movement and performance as under:

VEHICLE LOG BOOK (*pro-forma*)

Department:

Date:

Vehicle number:

Shift:

Driver's name:

1. Departure from workshop: ____ a.m./p.m.
2. Return to workshop: ____ a.m./p.m.
3. Fuel taken: ____ Litres.
4. Kilometre reading at start of work:
5. Kilometre reading at the end of work:
6. Total mileage/kilometres:
7. Details of trips made and locations covered:
8. Inspected at point Number ____ by ____ at ____ am/pm
9. Weight recorded at weighbridge: Time in ____ Time out ____

Weighbridge Operators' signature:

Driver's Signature:

User:

Department's Signature:

(12) Inspection of workshop stores

- i. Whether the list of fast-moving items is maintained
- ii. Whether the list of critical items is maintained
- iii. Whether minimum level of stock is maintained
- iv. Items found to be out of stock
- v. Items found to be over-stocked
- vi. Deficiencies/ irregularities noticed
- vii. Action taken

Computerisation of inventory daily with in-and-out information, balance in stock and economic order quantity would be very useful to keep track of availability and replacement of spares.

(13) Monitoring of complaints

All complaints regarding SWM services should be registered at the relevant ward office and monitored on day-to-day basis by the ward officer, who should give specific time limits to the Supervisory Staff of Sanitation Department to dispose of the complaints and report compliance. Reviewing the number and type of complaints and timely corrective action taken on each one must form an important part of the weekly review by senior officers.

(14) Recovery of additional cleaning charges (*pro-forma*)

- | | | |
|------|---------------------------------------------|------------------|
| i. | Name of the ward | |
| ii. | Areas visited | |
| iii. | Addl. cleaning charges recovered: | Number
Amount |
| | From households | |
| | From shops | |
| | From offices | |
| | From other establishments | |
| | From road side vendors, eating joints, etc. | |
| | TOTAL | |

(15) Cost recoveries/penalties (monthly monitoring);

- i. Ward-wise cost recoveries for a variety of services rendered.
- ii. Ward-wise penalties or levy of administrative charges from offenders.

(16) Legal matters (monthly report)

Number of cases filed in court for violation of sanitation laws.

For the effective monitoring of SWM services, the information collected in various *pro-formas* should be carefully analysed and corrective measures taken promptly.

There should be route maps and duty charts with each of the supervisory staff, who should check whether work on site is going as per schedule and whether vehicles and manpower are giving optimum output. Wireless pagers or other communication networks are essential for effective communication and monitoring of services.

Monitoring Public Responses**(17) Public Participation (monthly report)**

- i. Total number of sweepers allotted for door-to-door waste collection work in each ward.
- ii. Number of sweepers getting good response from citizens in the matter of doorstep collection
- iii. Number of sweepers not getting response from the public
- iv. Percentage of public participation
- v. Improvement in this area over the last month

CHAPTER 6

FINANCIAL ASPECTS

6.1 Financial Discipline

Solid Waste Management is one of the most essential services and needs to be provided satisfactorily so that health and sanitation is maintained and the environment is well protected. This necessitates provision of minimum levels of service to ensure that all streets and public places are cleaned daily and the waste generated in the city is removed regularly and disposed of in an environmentally acceptable manner.

Solid Waste Management is an obligatory duty of every urban local body. No local body can escape the responsibility of providing this basic service on the grounds of paucity of funds. Each local body has to find or raise funds to maintain the minimum level of service recommended in this report.

Local bodies may therefore take the following measures simultaneously to find funds for SWM services:-

A Identify priority areas

- (i) Prioritise the services which the local body has to provide
- (ii) Accord high priority to SWM as it is an essential service and obligatory for the local body to perform
- (iii) Put all non-obligatory functions in a separate category of duties which may be performed only after providing adequate funds for satisfactory performance of all essential services
- (iv) Put a ban on wasteful expenditure

B. Inter-se priority among obligatory services :-

- (i) Decide the minimum level of service the local body would like to provide in each category of service in a given time frame
- (ii) Estimate the requirement of funds for the same
- (iii) Fix the *inter se* priority of the essential service, giving due priority to SWM services
- (iv) Allocate funds for each service
- (v) Decide the critical area in each service and utilise the funds to optimise the benefit to society
- (vi) Defer the expenditure which can wait

C. Improve collection efficiency

- (i) Critically look into the existing efficiency of tax collection and collection of charges, fees and other income sources prescribed by the local body
- (ii) Identify leakages or lapses in the system
- (iii) Plug leakages and maximise the efficiency of the collection of taxes, charges and fees
- (iv) Take professional or private sector help in this area wherever required
- (v) Direct the additional funds generated through this effort to essential services.

NOTE:- The revenues of the local bodies could go up substantially through such efforts without any increase in the rates or charges.

D. Review existing rates and charges

1. Review the existing rates of taxes and charges vis-a-vis the current cost of services.
2. Make sure that citizens are reasonably taxed for the services they receive. The rate of taxes may be suitably increased wherever they are very low, to reduce the gap between income and expenditure
3. Rationalise the property tax structure preferably on carpet area or plinth basis rather than a rent-based system
4. Introduce the element of cost recovery for specialised services rendered, particularly where doorstep services are given or non-domestic waste is collected

E. NGO/private sector participation

1. List out all the SWM activities performed by the ULB
2. Identify the areas where NGO or private sector participation or contracting-out of services is possible,
3. Make a shift in policy: instead of being a provider, become an enabler of the service, which can, for a price, be delivered to the people directly by the private sector, NGO or co-operative. This can reduce the burden on the local body. At the same time, the ULB's must carefully monitor the performance of the NGOs/private sector to ensure required levels of service

F. Review establishment costs

1. Critically review the establishment cost and the job requirement of officers and staff
2. Fix work norms carefully
3. Review manpower needs
4. Reduce surplus staff, if any, or re-deploy them where needed
5. Effect economy in expenditure in all activities of the local body

All the efforts from A to F will improve financial discipline and put the local body in a comfortable position to plan expenditure on essential items of work.

The improved fiscal efficiency of a local body may even make it eligible for funding by financial institutions.

Local bodies should maintain a sinking fund for planned and timely replacement of vehicles and equipment.

6.2 REVIEW OF THE FINANCIAL POSITION OF THE LOCAL BODIES BY THE STATE GOVERNMENTS

State Governments may guide their urban local bodies in putting their houses in order and improving their finances on the lines indicated above. It is possible that local bodies may not make concerted efforts to improve their finances and may eventually fail to deliver the services expected of them.

The State Governments may therefore review the efforts made by the local bodies to improve their finances from time to time and ensure that they

- i. levy/impose adequate taxes to cover the cost of services they are expected to provide, without requiring legislative approval
- ii. identify all current and potential tax payers and bring them on record for paying various taxes and user charges
- iii. have an effective mechanism for the recovery of taxes and user charges imposed
- iv. take effective measures for the recovery of past arrears through enforcement and, if need be, by moving suitable amendments in law for expeditious recovery of outstanding dues
- v. introduce the element of cost recovery for services provided

6.3 ASSESSMENT OF GAP IN FINANCE

State Governments and Union Territories may, after reviewing the situation of each of their local bodies, advise them to undertake necessary reforms to improve their financial positions and then assess the gap between the funds required for the discharge of functions as per the 74th Constitutional Amendment and the funds local bodies can generate from their own resources under the powers vested in them. Thereafter need-based funds should be allocated by way of loans or grants to local bodies from the State Governments or Union Territories. All such allocations should clearly state the purpose for which the funds shall be utilised.

After determining the allocation of funds to the local body, the State Governments and Union Territories may take immediate measures to disburse funds as expected in the 74th amendment of the Constitution to bridge the gap. Such disbursements of funds may preferably be linked to improvements in performance and resource mobilisation by the local body.

6.4. FISCAL AUTONOMY TO LOCAL BODIES

In many States the local bodies are required to seek the permission of their State Governments in every case of raising their financial resources through taxes and charges.

To ensure that local bodies become self-sufficient, they should have the autonomy and empowered authority to increase the rates of taxes which they have been authorised to impose as well as to impose or increase any service charges to meet the cost of services.

The local bodies should also be authorised to levy or increase the minimum charges or tax without the prior approval of the State Governments.

6.5. LINK OBLIGATORY SERVICES /TAXES/FEES TO THE COST-OF-LIVING INDEX

Taxes need to be increased to meet the increase in cost of services. All service charges, fees, taxes and the like should be based on 1998 prices and be automatically increased annually by a percentage equal to the average percentage increase in the cost-of-living or inflation index.

6.6. LEVY OF CHARGES ON STATE & CENTRAL GOVERNMENT PROPERTIES

Property tax is the principal source of income for the non-octroi-levying local bodies. Many local bodies do not get property tax or adequate service charges from the Central or State Government for the urban properties owned or occupied by them. It is recommended that property taxes and/or service charge should be levied upon all Central and State Government/Union Territory properties on the same lines as other properties are assessed by the urban local bodies. The Government of India/State Governments may consider suitable legislative amendment to this effect.

6.7. TAX-FREE STATUS FOR MUNICIPAL BONDS

Where it is not possible to raise adequate resources from within and from the financial institutions, efficient and well-managed local bodies may wish to raise funds from the open market for the provision of essential services.

Municipal Bonds are one such funding source which needs to be tapped, as Ahmedabad has done. To give incentives to people to invest in Municipal Bonds floated by credit-rated cities, Municipal Bonds should be made tax-free to enable cities to raise funds at lower rates of interest.

Investments made for municipal infrastructure development should also qualify for the tax exemptions presently being given for creation of infrastructure such as power plants or irrigation projects.

6.8. PROPERTY TAX REFORM

Property tax is the principal source of income of the urban local bodies in non-octroi-levying states. It is unfortunate that the property taxes are levied at very low rates which have been generally rent-based and not revised for five years. Regrettably, large-scale exemptions and concessions are given to property holders. A lot of disparity is also seen in the manner of assessment of property tax. There is a need to have

area-based property tax reforms to make the system of assessment rational, transparent, simple and fair with minimum exemptions. The Patna or Gujarat State models of area-based property tax reforms could be considered by local bodies to make their property tax structure buoyant and invite willing compliance in self-assessment by all assesseees.

6.9. INCENTIVES TO RECYCLING INDUSTRY

Over 10% of the non-biodegradable waste produced is either re-usable or re-cyclable. Part of this waste is collected by rag pickers yet a sizeable portion goes to landfill. In a poor country like India, such a huge quantity of recyclable material should not be allowed to go waste. Collection of recyclable waste can be encouraged. Besides encouraging rag pickers to collect such waste door-to-door, steps may be taken for promoting the recycling industry through several incentives such as priority allotment of land, power and water, tax holiday for a few years, preferential purchase of recycled products by government and semi-government bodies, etc. This will promote the recycling industry, provide employment opportunities in the informal and formal sector, help in the utilisation of waste and simultaneously save the cost of collection, transportation and disposal of such waste.

6.10 FINANCIAL SUPPORT OF GOVT. OF INDIA AND STATE GOVTS TO URBAN LOCAL BODIES

The level of SWM service in urban areas is very low. The investments that have been made so far are in the areas of procurement of some vehicles and equipment for collection, storage and transportation of waste. Hardly any attention has been given to the treatment and disposal of waste, which is very vital and threatens the health and environment of the cities. Large investments will be required in the initial 3 years to upgrade the system and to set up the treatment, processing and disposal facilities, which local bodies may not be able to afford from their limited resources even after improving their finances to some extent on the lines indicated above. It is, therefore, strongly recommended that in the first 3 years all Class I cities of India may be given financial support by the Government of India as well as State Governments for the modernisation of their solid waste management systems in general and for setting up treatment, processing and disposal facilities in particular, as under :

A. – Support to Cities under 5 Lakhs population :

- (1) Setting up of compost plants and/or other treatment facilities
- (2) Upgrading existing sites and preparing Sanitary Landfill sites for disposal of waste.
- (3) Procuring vehicles and equipment needed to improve their solid waste management practices.

The estimated cost of the above 3 items may be shared equally by the Govt. of India, the concerned State Governments and the local bodies (33% each). Estimated cost per One Lakh population can be taken as under:-

1.	Vehicles and equipment	...	Rs.60 Lakhs
2.	Setting-up of compost plants	...	Rs.60 Lakhs
3.	Preparation of disposal site	...	Rs.30 Lakhs
Total			Rs.150 Lakhs

Financial Support at the rate of Rs.50 Lakhs per one lakh population may be given by the Central Government as well as by the State Governments to the urban local bodies under 5 lakh population over a period of 3 years in three annual installments of Rs.10 lakhs, Rs.20 lakhs and Rs.20 Lakhs.

B. – Support to cities above 5 lakh population :

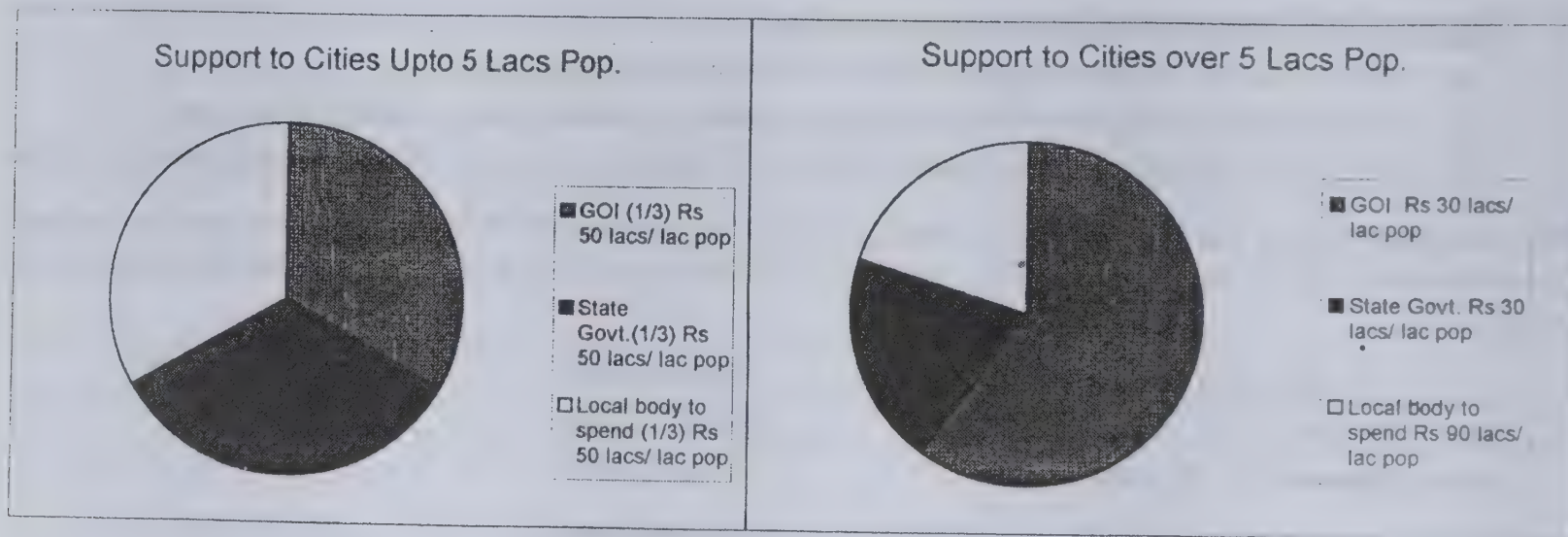
Cities above 5 Lakh population may be given financial assistance only for setting up the compost plant or waste treatment/processing plant and for preparing the disposal site. These large local bodies should find their own funds for the procurement of vehicles and equipment. The requirement of funds (per Lakh of population) for the treatment and disposal facility could be as under:-

1.	For compost or treatment plants	...	Rs. 60 Lakhs
2.	For land fill site development	...	Rs. 30 Lakhs
	Total		Rs. 90 lakhs

This amount may be contributed equally by the Central Government, State Governments and local bodies. Here the grant component may be Rs.30 Lakhs per one lakh population by the central government and an equal amount by the state government. This amount may be given in 3 installments of Rs.6 Lakhs, Rs.12 Lakhs and Rs.12 Lakhs over a period of 3 years per one lakh population. The local bodies may be given these grants subject to demonstrated improvement in SWM efficiency and fiscal prudence and on the condition that they would first put up their matching contribution in creating new facilities and put their share as well as the grants of the Government of India and State Governments, in a dedicated account to be opened for this purpose. The grant could be used for the procurement of land for compost plant or landfill site where the land is to be acquired from private parties or has to be purchased through negotiated settlements.

The Government of India and the State governments are urged to consider this recommendation for the overall improvement of the quality of life in urban areas. The improvement in solid waste management services will help in improving health conditions, greatly reduce the cost health and medical services and simultaneously increase the productivity of manpower for the benefit of both the city and the nation.

Proposed Financial Support to ULBs by the Central & State Govt.



6.11 TRANSFER SAVINGS OF 10TH FINANCE COMMISSION GRANTS TO THE URBAN LOCAL BODIES

The 10th Finance Commission had earmarked Rs. one thousand crores for allotment to States between 95-96 and 99-2000 for pro-rata release of Rs.250 Crores a year from 1996-97. However, in 1997-98 the urban local bodies did not get release of the full amount for various reasons. One of the ways the Govt. of India can meet the recommendation to support urban local bodies is to release these gap funds to set up the Technology Mission proposed to be created for implementation of these recommendations to improve urban Solid waste management systems.

6.12 LOCAL BODIES TO AVAIL OF LOANS FROM HUDCO / FINANCIAL INSTITUTIONS LIKE IREDA / LIC

The Housing and Urban Development Corporation (HUDCO) has expressed its willingness to finance solid waste management projects. Urban local bodies can avail of these loans, to the extent of 70% of the Project cost, through HUDCO's regional offices located in various States. Local bodies may also avail of loan facilities from other financial institutions in the country.

6.13 CHANNELISE SWM FUNDS WITH VARIOUS MINISTRIES AND FINANCIAL INSTITUTIONS

Several ministries such as the Ministries of Environment and Forests, Non-conventional Energy Sources, Agriculture and Urban Development have been supporting a variety of SWM projects under different schemes and such funds are allocated by the concerned ministries directly to the states or the cities. Similarly, several national financial institutions and international donor agencies have also funded various SWM projects for different states. There is no inter-coordination in the allocation of these funds. Several cities do not get access to such funds. It is necessary that funds earmarked for SWM projects by various Ministries are channeled through a single agency so that judicious need based distribution of funds can be done and these funds can be optimally utilised. The proposed Technology Mission would be the best agency to channelise these funds.

6.14. ALLOCATION OF LARGER FUNDS TO URBAN SECTOR

There is a need to look into the overall allocation of funds to the Urban Sector vis-a-vis the Rural Sector in view of the rapid pace of urbanisation in the country, particularly in view of the fact that decennial urban population growth is over 36%, as against rural growth of 19.7%. The Planning Commission is urged to consider allocation of more funds for urban development, so that adequate funds may become available to the SWM sector to improve the overall quality of life in urban areas.

6.15 GOVERNMENT OF INDIA SCHEMES TO HAVE SWM COMPONENT

Ongoing schemes like Integrated Development of Small and Medium Towns (IDSMT)/Mega City Project/ National System Development Project (NSDP)/Urban Basic Service Programme (UBSP) should have an SWM component. Swarna Jayanti Sheheri Rozgar Yojna (SJSRY) can be used to finance transportation of waste through unemployed youth.

6.16 SUPPORT TO PERI- URBAN AREAS

While recommending financial support to Class 1 cities in India for improving the SWM systems, it is suggested that the Government of India, Ministry of Rural Development may simultaneously focus attention on the SWM practices adopted in the peri-urban areas which are a part of the urban agglomerations of Class 1 cities, so that the environmental protection measures taken by Class 1 cities are not negated by the harmful impacts of the insanitary conditions prevailing in the peri-urban area.

CHAPTER 7

HEALTH ASPECTS

Improper Solid Waste Management gives rise to problems of health, sanitation and environmental degradation. WHO studies have indicated that 22 diseases are directly linked to improper solid waste management practices. Rodents and vector insects transmit various diseases like dysentery, cholera, plague, typhoid, infective hepatitis and others.

Special epidemiological studies have also shown that workers engaged in SWM services are exposed to high health risks and frequently suffer from respiratory tract infections, gastro-intestinal parasites and worms. The organic component of solid waste provides food and shelter to disease-carrying rodents and insects. Indian domestic waste contains human excreta, bio-medical waste and sometimes other toxic and hazardous wastes too. Improper management of waste can therefore spread several diseases. The rag pickers who move from street to street, bin to bin and go to dump yards to retrieve recyclable waste are most vulnerable to diseases on account of their direct contact with contaminated waste. They are also found to suffer from intestinal and respiratory infections, skin disorders and eye infections. They may suffer from injuries at open dumps, which can cause tetanus and serum hepatitis. Unscientific disposal of waste also pollutes groundwater resources with heavy metal and other contaminants through leachate, which pose serious problems of environmental deterioration and health risk. It is therefore essential that all stages of solid waste management be handled carefully to minimize health risks.

Special care should be taken to ensure that:

1. Containers are used for storage of waste at source as well as for the temporary bulk storage of waste at community level
2. Waste stored at the source of generation is collected daily before it starts decaying and emanates foul smell
3. Workers are adequately trained in waste handling and protecting themselves from the health risks involved in their occupation
4. The workers are given protective clothing and shoes and persuaded or requested to use them.
5. Composting sites are properly managed, rejects are scientifically landfilled and covered to control the spread of rodents, flies and other vectors.
6. Wastes should not be burnt on the streets or at the compost-yard of landfill sites as it causes pollution.
7. Landfill sites are properly managed and monitored to prevent groundwater pollution.

Besides managing the solid waste as indicated above, the following additional measures may also be taken to improve the sanitary conditions in the cities.

7.1 SPECIAL ATTENTION TO SLUMS AND TRADITIONALLY DIRTY AREAS

Since a city is only as clean as its dirtiest areas, which affect the health and quality of life of all its citizens, the slums and traditionally dirty areas, whether legalised or not, should be given special attention and provided full SWM services.

7.2 IMPLEMENT LOW-COST SANITATION PROGRAMMES TO PREVENT OPEN DEFECATION

Human excreta is one of the most insanitary components of urban solid waste. Open defecation should therefore be stopped by creating adequate sanitary facilities of individual, group or pay-and-use toilets for the urban poor, on a priority basis.

7.3 TEMPORARY TOILETS AT CONSTRUCTION SITES

All sites where a labour force is deployed for carrying out construction activities should have the basic facilities of toilets and urinals to prevent open defecation. Such provision at construction sites should be a prior condition for granting building permits.

7.4 COVERING OF BUILDINGS UNDER CONSTRUCTION

A lot of dust comes on the street from buildings under renovation and unhealthy conditions are created. To prevent this, it is recommended that all Town Planning Authorities should ensure that when any building is taken up for repairs, renovation, maintenance, demolition or construction, it is properly covered and curtained by the owner of the structure.

7.5 CATTLE NUISANCE

No stray cattle should be allowed on the streets. All existing cattle sheds, wadas and go-shalas should be removed to the outskirts in a phased manner from cities over 5 lakh population. Cattle should be stall-fed and the waste produced in such stables should be disposed of by the cattle owner on a daily basis at the community storage sites. Owners of these animals should be suitably charged for the disposal of such trade waste in the municipal system.

7.6 HEALTH MONITORING FOR SANITATION WORKERS

Urban local bodies should take action to protect all waste handlers from the ill-effects of their occupation. They should be given annual medical examinations and monitoring, appropriate health education and free medical treatment if it is felt that the illness is occupation-related.

7.7. PREVENT INDISCRIMINATE USE OF PESTICIDES¹

Indiscriminate use of pesticides, insecticides, disinfectants, etc., at the dust bins as well as the waste disposal sites must be stopped. Such use may be made only under the expert advice of the health authorities in exceptional circumstances.

7.8 NON-MUNICIPAL AUTHORITIES OPERATING WITHIN THE CITY OR ADJACENT TO THE CITIES TO FOLLOW THESE INSTRUCTIONS

Urban areas such as those under the ownership and/or management of the Railways, Defence, Port Trust, Industrial Townships, Improvement Trust, Urban Development Authorities and urbanised, peri-urban bodies quite often ignore the Solid Waste Management aspects in their areas. This poses a threat to the health and environment not only in the areas controlled by them but also in adjacent areas. All these authorities must therefore also follow the SWM systems recommended in this report to maintain overall health in Class 1 cities and their surroundings.

¹ The Supreme Court on 28.7.1997 in WP 888/96 directed. "The respondents are directed immediately to take steps to phase out the routine use of insecticides like DDT & BHC and similar dangerous insecticides on garbage heaps and dump sites."

CHAPTER 8

LEGAL ASPECTS

Solid waste management systems adopted in Indian cities are highly inefficient and outdated, lacking public participation. Overall public apathy is observed in the matter of handling and disposal of municipal waste. A system of throwing garbage on the streets by citizens and local bodies collecting the waste from the streets and disposing of it in the most unhygienic manner is in vogue. These systems can be corrected by taking concerted measures involving the public at large through their active participation in the process, and by local bodies performing their duties effectively.

Solid waste management practices can never reach the desired level of efficiency until the public participates and discharges its obligation religiously. The system therefore, can only be improved by modernizing the solid waste management system by the urban local body and ensuring public participation through very serious motivational efforts along with adequate legislative support for taking punitive measures.

Local bodies in the country are governed by various laws enacted by their respective States. Many State laws governing urban local bodies do not have adequate provision for ensuring appropriate solid waste management systems with the result that outdated systems continue to affect the quality of life of the people. For improving solid waste management practices in urban areas it is necessary to incorporate suitable provisions to ensure public participation and provide for a minimum level of service in the State laws governing local bodies.

Local laws also need to provide for punishment on the spot to those who do not adhere to the directions given for maintaining appropriate solid waste management system in the urban areas giving adequate power to the local authorities to punish the offenders.

The following legal provisions may be incorporated in the respective State laws wherever they do not exist in their laws governing urban local bodies.

8.1 LEGAL PROVISIONS

1 Duty of occupiers of premises to store solid waste at source of generation

It shall be incumbent on the occupiers of all premises to keep two receptacles, one for the storage of food/organic/bio-degradable waste and another for recyclables and other types of solid waste generated at the said premises. The domestic hazardous waste shown in Annexure E shall, however, be kept separately in a suitable container as and when such waste is generated.

2 Duty of occupier not to mix recyclable /non-biodegradable waste and domestic hazardous waste with food waste etc.

It shall be incumbent on the occupier of any premises to ensure that the recyclable waste as well as domestic hazardous waste generated at the said premises does not get mixed with the food/bio-degradable waste and that they are stored separately.

3 Duty of Societies/Associations/Management to provide community bins

It shall be incumbent on the management of Co-operative Societies, Associations, Residential and Commercial Complexes, Institutional buildings, markets and the like to provide community bin/bins of appropriate size as may be prescribed by urban local body, for the temporary collection of waste other than recyclable waste and hazardous waste, to be stored at their premises for its primary collection by the municipal authorities. A separate community bin may also be provided for the storage of recyclable waste where door-to-door collection of recyclable waste is not practiced.

4 Receptacles to be kept in good repair

Receptacles as stated in 3 above shall at all times be kept in good repair and condition and shall be provided in such number and at such places as may be considered adequate and appropriate to contain the waste produced by the citizens supposed to be served by the community bins.

5 Duty of occupiers to deposit solid waste in community bins

It shall be incumbent on occupiers of all premises for whom community bins have been provided as per 3 above, to cause all segregated domestic waste, trade waste and institutional waste from their respective premises to be deposited in the appropriate community bins.

6 Duty of Local Body to provide temporary Waste storage depots

It shall be incumbent on all Municipal Corporations and Class I municipalities in the State to:

1. Provide and hygienically maintain adequate waste storage depots in the city and place large mobile receptacles at such places for the temporary storage of waste collected from households, shops and establishments as well as from streets and public spaces, until the waste is transported to processing and disposal sites.
2. Make adequate provision for closed containers in various parts of the city for the deposition by citizens of domestic hazardous waste material listed in Annexure E.

7 Duty of occupier of household/ shop/ establishment to hand over the recyclable material/ non-biodegradable waste to the waste collectors/ waste purchasers/ recyclers

It shall be incumbent on households/ shops/ establishments to hand over their segregated recyclable waste/ non-biodegradable waste to waste collectors, waste purchasers or recyclers as may be convenient or as may be notified by the local body from time to time. Such waste shall not be disposed of on the street or in municipal bins or open spaces along with the organic/food/bio-degradable waste.

8 Duty of urban local bodies to collect waste from community bins and to deposit it at Bulk Community Waste Storage Sites for onward transport

It shall be incumbent for urban local bodies to remove all solid waste deposited in community bins on a daily basis and transfer it to the temporary Waste Storage depots/containers identified in the city or arrange for its expeditious transport to processing or disposal sites.

9 Duty of urban local bodies to clean all public streets, open public spaces and slums

It shall be incumbent on urban local bodies to arrange for cleaning of all public streets having habitation on both or either side, and all slums on all days of the year including Sundays and public holidays.

10 Duty of urban local bodies to transport the waste stored at the waste storage depot regularly.

It shall be incumbent for the urban local bodies to arrange for the transportation of waste stored at open waste storage depots daily and before the waste storage containers start overflowing, at places where closed containers are placed.

11 Duty of urban local bodies to arrange for composting of organic/food/bio-degradable waste and disposal of rejects

It shall be incumbent for the urban local bodies to arrange for the composting of food / organic / bio-degradable waste produced in the city and to dispose of the rejects and non-biodegradables in an environmentally acceptable manner.

12 Prohibition against littering the street and deposit of solid waste

No person shall litter public streets or public places or deposit or cause or permit to be deposited or thrown upon or along any public street, public place, land belonging to the local body or any unoccupied land or on the bank of a water-body, any solid waste except in the receptacles specified in 1, 5 and 7 above.

13 Prohibition against deposition of building rubbish

No person shall deposit or cause or permit to be deposited any building rubbish in or along any street, public place or open land except at a place designated for the purpose or in conformity with conditions laid down by the municipal corporation/ municipality.

14 Prohibition against flow of filthy matter on public places

No owner or occupier of any building or land shall allow any filthy matter to flow, soak or be thrown therefrom, or keep or suffer to be kept therein or thereupon, anything which is or can become a nuisance to any person, or negligently suffer any receptacle or place for the deposit of filthy matter or rubbish on his premises to be in such a state as to be offensive or injurious to health.

15 Prohibition on disposal of carcasses etc.

No person shall deposit or otherwise dispose of the carcass or parts of any dead animal at a place not provided or appointed for this purpose.

16 Punishment for littering on streets and depositing or throwing any solid waste in contravention of the provisions of the rules

Whosoever litters the street or public places or deposits or throws or causes or permits to be deposited or thrown any solid waste or construction debris at any place in contravention of the provisions of this Act or permits the flow of any filthy matter from his premises shall be punished on-the-spot with a fine not less than Rs.50/- as may be prescribed under the rules framed by the State Govt. from time to time. Such spot fines may be collected by officers authorised by the Municipal Corporation/Municipality, not below the rank of sanitary inspector. The amount of fine imposed shall be recoverable as arrears of property taxes. The amount of fine shall be kept higher for repeat offences.

CHAPTER 9

PUBLIC AWARENESS

9.1 Reduce, Re-use and Re-cycle (R-R-R)

Everyone is concerned with the growing problems of waste disposal in urban areas with the scarce availability of land for processing and disposal of waste. Environmental remediation measures are becoming ever more expensive. It is therefore necessary not to think only about effective ways and means to process and dispose of the waste that we generate each day. It is also essential to seriously consider how to avoid or reduce the generation of waste in the first place and to consider ways to re-use and recycle the waste, so that the least quantity of waste needs to be processed and disposed of. This requires a very effective public awareness campaign coupled with commitment by industries and the efforts of decision-makers at all levels.

While the quantity of food waste generated per capita has remained almost static, the quantity of packaging waste material and non-biodegradable waste is going up alarmingly every year. This increases the burden on local bodies to deal with the problem of non-biodegradable and non-recyclable components of waste landing up at processing and disposal sites.

The following measures are therefore proposed to Reduce, Re-use and Recycle waste:

- (i) All manufacturers producing a variety of domestic and non-domestic products, food as well as non-food, should seriously endeavour to use re-usable packaging materials so that after the delivery of goods, the packaging materials could be collected back and used over and over again. Manufacturers could also consider minimising or avoiding use of unnecessary packaging materials by innovative methods.
- (ii) Incentives and product discounts should be given to consumers for the return of packaging or bottling materials in good condition, to the waste producers or retailers to promote re-use.
- (iii) The cost of packed articles and articles without the packaging material could be kept different, with a choice to the consumers to take the article without the packaging material at low cost.
- (iv) The present trend towards one-time-use packaging needs to be reversed. Multi-use bottling practices need to be re-introduced.
- (v) Hard-to-recycle packaging like PET bottles, metalised plastic films and multi-film packs must be phased out unless producers take responsibility for their recall and recycling or re-use.

RE-USE

One person's waste can be useful material for others. Efforts should therefore be made to encourage collection of such re-usable material through waste collectors, waste producers, NGOs and the private sector, instead of allowing reusable waste to land up on the disposal sites. Bottles, cans, tins, drums and cartons can all be reused.

Conversion of non-recyclable and non-biodegradable packaging materials to recyclable and bio-degradable packaging material:

Of late, several hard-to-recycle packaging materials are being used increasingly, such as PET bottles for soft drinks and mineral water, styrofoam and soft-foam products for packaging consumer durables and metallised plastic films for packaging several food items. These wastes are hard to re-cycle or are not recyclable. Some of these products release ozone-depleting substances and toxic gases when they are re-cycled. It is therefore necessary to seriously consider switching over to the use of reusable or easily recyclable and eco-friendly packaging material to minimise the harmful effects of such packaging material. Use of bio-degradable plastic rather than non-bio-degradable plastic material for packaging may also be encouraged through tax rebates.

Disincentive: Levying of Eco-surcharge

While on the one hand the authorities controlling the industries and environment should promote the use of re-usable or eco-friendly packaging material and direct the industries to switch over to this in a given time frame, an eco-surcharge should meanwhile be levied on hard-to-recycle or ecologically unfriendly packaging to encourage compliance.

The Eco-surcharge so levied could be passed on to the Technology Mission proposed in this report to channel these funds to ULBs for improving their Waste Management practices.

RE-CYCLING

In the era of excessive packaging materials, a lot of recyclable waste material is generated. All-out efforts are necessary to retrieve recyclable material, as has been recommended in the report, and fed to the recycling industries.

9.2 Public participation

Public participation is the key to success in these efforts. Information, Education and Communication (I.E.C.) mechanisms should be used to ensure effective public co-operation.

9.3 PUBLIC INFORMATION, EDUCATION, COMMUNICATION AND AWARENESS PROGRAMS

For the successful implementation of any programme involving public participation, it is essential to spell out ways in which public participation in hygienic Solid Waste Management (SWM) can be promoted and ensured, hand in hand with Municipal initiatives.

Citizen co-operation is vital for keeping garbage off the streets, especially at the very first stage of keeping biodegradable “wet” kitchen and food wastes unmixed and separate from recyclable “dry” wastes and other hazardous wastes. If the reasons for this are explained, public participation is bound to improve. A series of measures can be taken to bring about a change in public behavior through public awareness campaigns, which could be as under:

1. Involvement of Professional Communicators

If messages are not conveyed in the right way, they may not yield the desired results. Professional inputs are necessary in developing a strategy for effective communication. Most large advertising agencies have Social Marketing experts to convey civic messages effectively. They can be contacted at the city or state level to create suitable messages for various uses, preferably free or at cost as a public service.

2. Information Hot-line

The key to success of any public education, awareness and motivation programme is to provide as many ways as possible for the public to interact, as promptly and conveniently as possible, with policy-makers, to seek clarification of doubts, share ideas or give suggestions which are constructively followed up. A telephone hot line or Post Box number for written communications could be among the ways to get inputs from members of the public. The hot-line should be manned during working hours (or even later) by polite, responsive and dynamic persons who are well informed, interested in the subject and available at all stated times. These communication channels (one or more) can be set up and monitored by using suitable in-house staff of the ULBs.

3. SWM Co-ordinator or Officer on Special Duty

Such information and communication services need to be kept active for at least one year. Larger ULBs will find it very cost-effective to engage an experienced communicator/ manager as SWM Co-ordinator or Officer on Special Duty, to interact regularly with the public in all the ways described here, to ensure that action time-tables for implementing the new practices are met in time, and that public willingness is punctually matched by ULB infrastructure such as hand-carts and good ULB management practices such as well-synchronised waste transfer points and timings.

4. Use of Hoardings

Special hoardings may be put in the cities covering messages seeking public participation. Alternatively, all municipally licenced hoardings should have a space reserved for civic messages. This will add a “socially-aware” image to the advertisers and will not reduce the usefulness of the hoarding to them at all. The messages can be those developed by advertising agents to promote any of the recommendations of this new waste-management policy. The hoardings should also publicise the hot-line numbers etc.

5. Use of Public Transport

Brief messages such as “Roads are not for garbage” or “Keep your wastes unmixed” or cartoons of house-to-house collection, can be painted on the rear of public buses and in local train compartments. Public or private firms with their own bus fleets may also be invited to co-operate.

6. Use of Cable TV and Cable channels

This is a very powerful medium and can be used in a ward-wise manner to inform citizens of new collection arrangements and timings as they become operational and give contact numbers of concerned officials for problem-solving or reporting of SWM-related grievances.

Most importantly, they can be used to publicise successful efforts and interview participants in such localities and trade groups. This will strongly motivate other citizens to perform likewise and get similar recognition for their efforts.

7. Use of Radio and TV

These can similarly showcase statewide or national-level successes in hygienic SWM in order to motivate or inspire other ULBs to follow suit.

8. Use of Newspapers

Local newspapers can be requested to insert regular banner messages on SWM along the bottom of their city pages on a daily or weekly basis. They should also be encouraged to start a regular Suggestion Box on the city page, where good news or ideas can be showcased by the public. Advertisements can also be issued from time to time to create public awareness.

Newspapers should be encouraged to give coverage to successful initiatives that have overcome such problems in a constructive way.

ULBs can usefully take advantage of newspaper delivery services by inserting handbills for readers in a particular locality to announce the start of house-to-house collection or dry waste collection arrangements in that area.

9. Use of other Media

Slides in cinema theaters and posters at public places can similarly inform and motivate the public.

10. NGO involvement

Many NGOs are committed to improve SWM practices in urban areas to protect the environment and have been very active in this field. They have also developed good mass-communication skills and education programs for the public. Such NGOs may be persuaded to actively support the new strategies recommended in this report and associate it in public awareness campaigns. Those that wish to conduct programs for sections of the public on the new SWM strategies should be encouraged to do so through direct support or through use of ULB facilities and support systems as could be seen from the photographs below:



Photo 42: NGO effort to mobilise regpickers

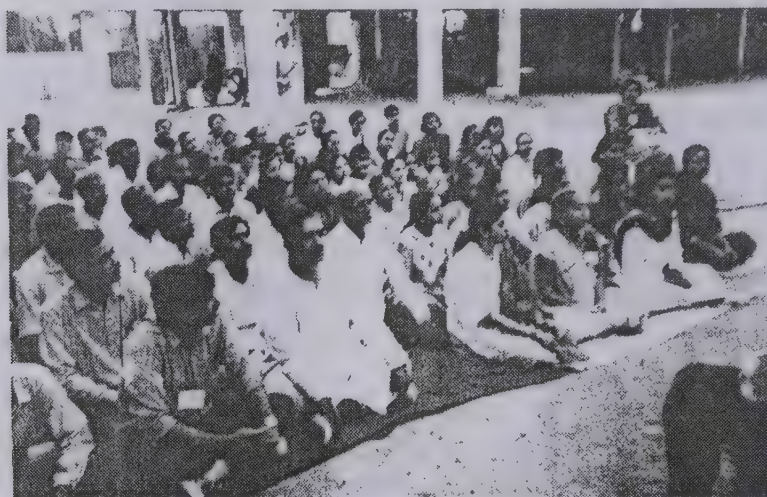


Photo 43 : NGO effort to mobilise & motivate citizens for participation in storage of waste at source & primary collection of waste



Photo 44: Public awareness drive by a city corporation

11. Use of Schools and Colleges

Children are powerful communicators. Parents who do not listen to advice from others will often take their own children seriously. Children are idealistic and would like to change their world for the better. The SWM Co-ordinator and other groups described above should hold regular meetings with principals, teachers and students to explain the need for change, and the usefulness to society of new ways to manage waste. The message can be reinforced by holding essay, debate or drawing/painting competitions on the subject and publicising the winning contributions through all the media described above. Firms and social clubs can be encouraged to sponsor many such events to keep the topic alive in a fresh way every week or month.

12. Use of Ward Committees

Ward Committees should use their good offices for public involvement to make their wards the first to stop using the streets for waste disposal. ULBs can announce Ward-of-the-Month rewards.

13. Use of NCC, NSS, Scouts and Guides

Such groups are leading change-makers. Their activities can be designed to match with and support the changes desired by the ULB and society. They can especially be trained and involved in going house-to-house in target areas with leaflets or verbal instructions on how to segregate garbage off the streets and how to manage debris and building materials without inconveniencing the public.

14. Street Committee and Resident Associations

Most citizens want a nearby facility to dispose of their waste, but nobody wants a dustbin at his own doorstep. Both needs can be met by the house-to-house mobile dustbins (handcarts or tricycles). Neighborhoods can be rewarded for good response to doorstep collection of segregated waste, by removal of the offending street bins from their area. Groups that undertake to manage the cleaning of their own area can be rewarded by ULBs through grants/subsidies.

15. Involving Commercial Sponsors

Firms can be encouraged to adopt certain areas or sponsor cleanliness drives and give awards to those who maintain cleanliness in the selected areas.

16. Awareness Camps and Literacy Programs

Many camps are held for different purposes under SJSRY, LCS, NDP and adult literacy programs. Better ways to manage waste can form a part of the dialogue and instruction at all these forums.

CHAPTER 10

CONSTITUTION OF A TECHNOLOGY MISSION FOR IMPROVING SWM PRACTICES IN THE COUNTRY WITHIN FIVE YEARS

With a view to ensuring that the recommendations made in this report are effectively implemented by all Class I cities in the country, it is strongly recommended that a high powered autonomous Technology Mission on SWM be constituted by the Government of India under the Ministry of Urban Development, for a period of 5 years.

The Mission's mandate may be to ensure the implementation of the recommendations made in this report for all Class I cities in India within a given time frame.

The role and objectives of the Technology Mission:

1. to monitor the performance of various local bodies in the implementation of these recommendations,
2. to collect information on various technologies for the processing and disposal of wastes, to identify the suitability of the technology under Indian conditions, through pilot projects where necessary and to advise the State Governments and urban local bodies to adopt such technologies.
3. to give technical assistance to the local bodies in adopting the suggested technologies wherever required.
4. to provide and channel funds earmarked for SWM projects by financial institutions and international financial donor agencies, as well as by various Ministries such as Environment & Forests, Non-conventional Energy Sources, Agriculture, Urban Development and the National Planning Commission.
5. to develop IEC (Information, Education & Communication) material and awareness programmes and disseminate the same through mass media and other communication methods
6. to promote capacity building and Human Resource Development (HRD) in ULBs and identify the training needs of the urban local bodies; to develop mechanisms to meet the training needs and designate institutions in each state/ region as resource centres for providing such training.
7. to benchmark performance indicators and circulate the same to urban local bodies and state governments.
8. to arrange, promote and coordinate inter-city and inter-state meets for SWM personnel to exchange information and technology.
9. to provide a forum for public interaction and intervention in the field of SWM and strengthen and support citizen participation.
10. the Mission may take such other measures as may be necessary to improve the solid waste management systems from time to time.

All government grants and loans to the urban local bodies for Solid Waste Management related matters should be routed through the Technology Mission which may weigh the proposal.

The Government of India should place adequate resources at the disposal of the Technology Mission to achieve its objectives.

Composition of Technology Mission

Secretary to Government of India from the Ministry of Urban Affairs and Employment	...	Chairman
Secretary to Government of India - Ministry of Environment & Forests		Co-Chairman
Representatives of		Members
Ministry of Health	...	1
Ministry of Agriculture	...	1
Ministry of Finance	...	1
Planning Commission (all at the level not below the rank of Joint Secretary of Govt. of India.)	...	1
Secretaries in charge of Urban Development Dept. Municipal Administration from State Governments	...	2
Municipal Commissioner from Mega City.	...	1
Municipal Commissioner from 1 million plus city	...	1
Municipal Commissioners/Chief Officers from small cities	...	2
Non-Governmental Organisation representatives	...	2
Experts on the subject	...	4
Directors/Senior Professors from State Resource Centre/training institute	...	2
Director General not below the rank of Joint Secretary to Govt. of India.	...	1
Total :		21

The Technology Mission should have an Executive Committee headed by a full-time Director General and 10 members from among the members of the Technology Mission as may be decided by the Mission. The Director General should have a tenure of at least three years and have technical and administrative staff and be given adequate funds and powers to fulfil the objectives of the mission.

The mission shall meet once in six months and the Executive Committee at least once in two months.

CHAPTER 11

CLASSIFICATION OF RECOMMENDATIONS

The recommendations made in this report can be grouped into 2 categories as under:

A. MANDATORY RECOMMENDATIONS

B. DISCRETIONARY RECOMMENDATIONS

11.1. Mandatory recommendations for citizens/ associations

- (1) Not to throw any waste on the streets, lanes, bylanes, footpaths, open spaces, water bodies etc.
- (2) Store organic food and bio-degradable waste at source in personal domestic bins.
- (3) Segregate and store separately, recyclable waste, non-biodegradable waste and domestic hazardous waste at source.
- (4) Provide community bins in MSBs/commercial complexes
- (5) Deposit domestic, trade and institutional waste in the hand-carts/tricycles/community bins/vehicles as notified by ULBs
- (6) Trim the garden waste on the days notified by the local body
- (7) Store construction waste within the premises or, with permission, outside the premises
- (8) Hospitals, nursing homes, health care establishments and industries to make their own arrangements for collection, transportation and disposal of their industrial and bio-medical waste.

11.2. Mandatory Recommendations for Local Bodies/ State Governments

- (1) Initiate public awareness campaigns through IEC (Information, Education and Communication) strategy.
- (2) Primary collection of waste from doorstep/ community bins with or without community participation
- (3) Street sweeping on all days in the year irrespective of Sundays and Public Holidays, making adequate provision for giving statutory weekly off to the workers, or compensating them for working on holidays, etc.
- (4) Provision of mobile/bulk community waste storage containers (large size containers/ tractor trolleys) at the waste storage depots
- (5) Transportation of waste at regular intervals before the containers start overflowing.
- (6) Collection, transport and disposal of market waste, hotel and restaurant waste, construction waste, Kalyan Mandap/marriage hall waste and garden waste, with participation of waste-producers.
- (7) Cities with population above 5 lakh should provide weighbridges at processing and disposal sites.
- (8) Arrange for composting of all bio-degradable waste into bio-organic fertilizer.
- (9) Disposal of non-compostable waste and rejects at the sanitary secured landfill site in an environmentally acceptable manner.

- (10) Remedial measures to make old dumpsites safe.
- (11) Identification and procurement of sites for composting and disposal of waste for the next 20 to 25 years (state governments and local bodies jointly).
- (12) Provision of toilet facilities to prevent open defecation
- (13) Special attention to the cleaning of slums and dirty areas
- (14) SWM activities to be kept under one umbrella
- (15) Management Information Systems for strict SWM monitoring.
- (16) Declaration of a no-development Buffer Zone within 500 metres from the boundary of all reserved processing and disposal sites.

11.3. Discretionary Recommendations for Urban Local Bodies

- (1) Choice of technology, types of bins and vehicles to be used
- (2) Work norms for workers and vehicles deployed
- (3) Measures for institutional strengthening
- (4) Supervisory levels to be deployed
- (5) Human resource development
- (6) Allocation of funds
- (7) Health check-ups for all SWM workers and staff
- (8) Obligatory functions to be given priority over non-obligatory functions and allocation of funds accordingly. Enhancement of financial position through plugging of leakages and improved recovery of taxes and charges and introduction of mechanisms for automatic annual increase in taxes and charges to cover the inflationary trends.
- (9) Introduction of area-based property tax reforms
- (10) Suitable provisions in the building by-laws to earmark places for keeping community bins for storage of wastes in high-rise buildings and commercial complexes.
- (11) Amendments in the State laws to improve solid waste management services.
- (12) Development and wide dissemination of a citizens' charter.
- (13) Introduction of a system of administrative charges/special cleaning charges to be levied upon those who violate the SWM code of conduct.

CHAPTER 12

SUGGESTIONS FOR THE CONSIDERATION OF CENTRAL AND STATE GOVERNMENTS/U.T.s

Set up a National Technology Mission for SWM	Central Govt.
Place SWM on the National Agenda	Central Govt.
Central and State Governments to share funds with the local bodies and make them financially sound for implementation of the 74th Amendment of the Constitution	Central and State Govts./ U. Ts.
To give financial support to local bodies for setting up treatment and disposal facilities.	Central and State Govts/U. Ts.
Give Tax free status to Municipal Bonds of creditrated cities	Central Govt.
*Constitute a District level Committee comprised of (i) the District Collector (DC) (ii) the Municipal Commissioner/ Chief Executive of the concerned local body, and (iii) the person in charge of SWM of the civic body, to identify, within three months, suitable sites for urban solid waste processing and ultimate disposal of waste which can serve for at least 20-25 years, allowing for projected future population. The Committee shall forward the proposal for allotment/acquisition of land within three months.	State Govts./ U. Ts.
*Appoint an Empowered Committee to give necessary clearance for allotment of Govt. land or acquisition of private land within 6 months from the date of receipt of proposal from the District Committee. The possession of the approved Govt. land shall be given to the ULB within 6 months.	State Govts./ U. Ts.
*Arrange for land acquisition proceedings under the urgency clause, if the land is to be acquired.	State Govts./ U. Ts.
*Notify adequate Buffer Zones or No-Development Zone surrounding the newly selected sites.	State Govts./ U. Ts.
*Before planning for any human settlements for residential, commercial, industrial or any other purpose, include adequate spaces for waste collection, bulk storage as well as for long term processing and disposal of waste in the regional Master Plan and Town and Country land use plans.	State Govts./ U. Ts.
To suitably amend the Contract Labour (Regulation and Abolition) Act, 1970 to facilitate public private partnership and NGO/private sector participation in SWM services.	Central Govt.
To make a special provision to safeguard the supervisory staff of SWM dept. against the abuse of the Scheduled Caste, Scheduled Tribes (Prevention of Atrocities) Act 1989	Central Govt. / State Governments/ U. Ts.
Local bodies as well as Regional Planning Authorities like the District Planning Committee and Metropolitan Planning Committees, Improvement Trusts and Urban Development Authorities, etc., to make adequate provision of appropriate land for setting up temporary waste storage depots in each city and for setting up compost plant and sanitary landfill sites in land-use plans, which can remain in use for at least 20 years.	State Govts./ U. Ts.

SWM infrastructure to be a pre-condition in New Development Areas.
The Provision of SWM infrastructure like waste collection, temporary storage, transfer, processing and disposal of waste should be made a mandatory pre-condition of urban planning by Improvement Trusts, Urban Development Authorities, etc., in all new development areas. This should be strictly enforced

State Govts./ U. Ts.

Incentives for setting up Compost Plants

The following incentives may be given, to encourage the installation of compost plants in the country:

Central and State Govts./ U. Ts.

- a) Composting of waste to be deemed an Agricultural Activity.
- b) Compost plant not to be subjected to payment of Non Agricultural Conversion charges.
- c) Compost plant to be deemed a pollution control investment.
- d) Compost plants should be declared as pollution abatement measures and given the benefits enjoyed by other industrial pollution-control investments.
- e) Single-window fast-track clearance for allotment of plants and issue of various NOCs, permissions, etc., for setting up compost plants
- f) Social Infrastructure status for city waste conversion processes, entitling them to priority finance at concessional rates of interest
- g) Compost / organic manure plants to be included in the definition of Infrastructural Facility and deemed a "Sanitation System" u/s 10 Clause 23G (c) (ii) of the Income Tax act, similar to water-supply and sewerage systems
- h) Excise exemption for plant and machinery intended for manufacture and testing of organic manure from urban solid waste.
- i) Sale of organic manure and vermi-compost to be exempt from sales tax
- j) National and State Agriculture and Fertiliser Policy to focus on re-vitalisation of Indian soils by promoting the use of city composts within a reasonable distance of its production, at a reasonable price acceptable to cultivators
- k) Arrange demonstration farming with compost to create a demand for compost by farmers. Help in marketing mechanism for the sale of compost.

Incentive to recycling industry through allotment of land water, power, tax-holiday, purchase of recycled goods etc.

Central / State Govts./ U. Ts.

*** Note : These recommendations may be treated as mandatory.**

CHAPTER 13

TIME FRAME

The recommendations made in this report are very simple and implementable. However, there is need for massive awareness campaigns with public/NGO participation. Looking to the prevalent level of services in urban areas, the in-house capacity of ULBs and the extent of public and NGO participation, the local bodies will need some time to gear up their machinery for the implementation of these recommendations. Procurement of tools for the sanitation workers, containers for waste-storage depots, vehicles for transportation of waste, setting up of processing plants and construction of disposal sites will take considerable time as the availability of tools, vehicles and equipment in the market is limited and manufacturing of these tools and equipment in bulk will take a long time. The following time frame is therefore recommended for the implementation of these recommendations by Class I cities, Central/ State Governments and Union Territories.

(1)	Setting up a Technology Mission	6 months
(2)	Identification of NGOs, CBOs, Citizen Associations, and Public awareness campaigns for public participation	6 months
(3)	Storage of waste at source by the citizens	9 months
(4)	Storage and segregation of recyclables at source	9 months
(5)	Provision of containerised handcarts for all sweepers	9 months
(6)	Primary collection of waste through sweepers in their handcarts.	9 months
(7)	Primary collection of waste from :-	
	(i) vegetable markets	12 months
	(ii) Fish/meat markets	12 months
	(iii) Hotels, restaurants, construction sites	18 months
(8)	Tender process to be completed for the procurement of containers for waste transport storage depots, vehicles. etc.	18 month
(9)	Actual procurement of large containers and the vehicles for lifting/carrying such containers, other vehicles, equipment etc.:	
	for 0.5 million plus cities	24 months
	for all other Class I cities	36 months
(10)	Processing & disposal of waste: Selection of proper sites for the setting up of compost plant as well as for disposal of waste by the District Level Committee.	3 months
(11)	Decision of Govt. to allot government land if found suitable and give possession of land	6 months
(12)	Acquisition/ procurement of the land if govt. land is not available.	18months
(13)	Remediation of old disposal sites	18months
(14)	Setting up of compost plant / treatment / processing plant in 0.5 million plus cities	24 months
	in other class I cities	36 months
(15)	Construction of appropriate land fill site for disposal of waste	36 months

IN THE SUPREME COURT OF INDIA ORIGINAL JURISDICTION

WRIT PETITION (C) NUMBER 888 OF 1996

Almitra H. Patel & Another

... Petitioners

Vs.

Union of India & Others

... Respondents

ORDER

We have heard the learned Additional Solicitor General and Shri Vallapalli, learned Senior counsel. We consider it appropriate at this stage to constitute a Committee and to specify the specific aspects which the Committee is required to examine. We direct accordingly.

The Committee for Class-I Cities (having population over one lakh) shall consist of the following:-

- | | | |
|----|------------------------------------------------------------------------------------------------------------------|---------------------|
| 1. | Mr. Asim Burman
(Commissioner, Calcutta
Municipal Corporation.) | Chairman |
| 2. | Mr. S. R. Rao
(Secretary, SSI, Govt. of Gujarat & ex-Commr., Surat) | Member |
| 3. | Mr. S. K. Chawla,
Chief Engineer, CPWD | Member |
| 4. | Mr. P.U. Asnani
(Urban Env. Infrastructure
Rep. for India, USAID and
Consultant, Ahmedabad Mun. Corpn.) | Member |
| 5. | Dr. Saroj
(Jt. Director, Ministry of
of Environment & Forests) | Member |
| 6. | Mr. Rajat Bhargava
(Commissioner, Vijaywada Mun. Corpn.) | Member |
| 7. | Mr. Yogendra Tripathi
(Dy. Secy. Urban Dev. MOUA&E) | Member
Secretary |
| 8. | Mrs. Almitra Patel
(Convener, INTACH Waste Network) | Member |

The terms of Reference for the Committee shall be as under:

To look into all aspects of urban solid waste management, particularly:

1. Examine the existing practices and to suggest hygienic processing and waste disposal practices and proven technologies on the basis of economic feasibility and safety which the Corporation/Government may directly or indirectly adopt or sponsor.
2. Examine and suggest ways to improve conditions in the formal and informal sector for promoting eco-friendly sorting, collection, transportation, disposal, recycling and reuse.
3. To review Municipal bye-laws and the powers of local bodies and regional planning authorities and suggest necessary modifications to ensure effective budgeting, financing, administration, monitoring and compliance.

4. Examine and formulate standards and regulations for management of urban solid waste, and set time-frames within which the authorities shall be bound to implement the same.

The Committee is requested to give its report as early as possible preferably not later than 30th June, 1998. The Committee is also requested to give such interim reports as it may find convenient so to do.

The Secretarial assistance at Delhi will be provided by the Ministry of Urban Development which will also make all other arrangements required by the Committee for its proper functioning, while arrangements within the States/ Union Territories would be made by the concerned State/ UT. The expenses incurred for the purpose to the same extent would be borne at this stage by the Ministry of Urban Development and the concerned State Governments/ UTs. The final responsibility for meeting these expenses would be decided later on.

The Local authorities and concerned State Governments/ Union Territories shall extend all cooperation and assistance to the Committee for its proper functioning.

List the matter on 20th July, 1998.

Sd/- (S.K. VERMA)	CJI
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Sd/- (B.N.KIRPAL)	J.
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Sd/- (V.N.KHARE)	J.
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NEW DELHI
JANUARY 16, 1998

**Number, Type and Spacing of Street Bins and
Bin : Population Ratios in various Class I Cities of India**

#	City / Town	Popul- ation, Lakhs	Type of Bins used	No. of Bins	Bin: Population Ratio	Dist. Bet- ween Bins	Freq-uency of Clear- ance
Corporations:							
1	Agra	14.00 (1998)	Containers & dhalaos	32	1:44750	1 km	Twice a week
2	Ahmedabad	28.76	Containers & open sites	708	1 : 4000	200 mts	Daily / alt days
3	Bangalore	40.38	RCC rings, masonry structures	14000	1 : 288	100- 200mt s	Twice a week
4	Baroda	10.21	-do-	562	1 : 1835	-do-	-do-
5	Chennai/Madras	37.95	Round bottomless concrete +mason- ry structures.	18000	1 : 210	210 mts	Daily / alt days
6	Cochin	5.64	Concrete/MS bins	780	1:725	250mt	NA
7	Coimbatore	9.76	RCC + masonry str.	3600	1 : 500	100 mts	Once a week
8	Faridabad	12.00 (1998)	Open sites, Round metal rings, masonry str.	655	1 : 1830	200 mts	Twice a week
9	Khandwa	1.45	RCC, Masonry, Steel frame	225	1:645	200 mts	Daily
10	Kozhikode	4.20	Metal container / cement bins	700	1:600	50 mts	NA
11	Madurai	9.40	Round con-crete bins	654	1 : 1437	No data	Daily
12	Mysore	6.53	Cement bins	3385	1:193	50 mts	NA
13	Singroli	1.20	Masonry	NA	1:100	30mts	Daily
14	Ujjain	3.63	RCC, metallic	260	1:2000	200mt	Daily/ weekly
15	Trivandrum	5.24	Masonry / metallic	300	1:1746	750m- 1.5km	NA
16	Varanasi	9.29	Masonry	37	1 :25000	750mt	Twice a week
Municipalities							
17	Allappuzha	1.69	RCC bins/ boxes	240	1:740	200mt	NA
18	Gadag-Betegeri	1.34	RCC	NA	NA	100mt	Daily/ alt day/weekly
19	Kollam	1.39	Masonry	5	1:27800	NA	NA
20	Tirupur	2.35	Open places	36	1: 6527	100 mts	Daily/ alt day/weekly
21	Vellore	1.75	RCC bins	3020	1 : 600	200 mts	Alt days

SWEEPER : POPULATION RATIO & SWEEPER : ROAD LENGTH RATIO

#	City/Town	Population, lakhs	Road Length, Km	No of Sweepers for Street Sweeping	No of Sweepers for Waste Collection & Pick-up	Total No of Sweepers	Sweeper : Population Ratio	Sweeper : Road length Ratio, in metres	Work norms of Road Length (mtrs) or area (sq m) per Sweeper
	Corporations								
1	Agfa (in 1998)	14.00	N A	2650	-	2650	1 : 258	N A	N A
2	Ahmedabad	28.76	1250	6827	-	6827	1 : 421	1:183	3000sqm to 10000 sqm
3	Bangalore	40.38	1925	11000	-	11000	1 : 367	1 : 175	2000 sq m
4	Baroda	10.31	900	2200	-	2200	1 : 461	1 : 409	500 m
5	Chennai/Madras	37.95	2488	4950	-	4950	1 : 776	1 : 507	750 m
6	Cochin	5.64	577	201	-	201	1 :2805	1 :2870	1.5 km
7	Coimbatore	9.76	526	1492	175	1667	1 : 585	1 : 434	100 m
8	Faridabad (in 1998)	12.00	1502	2356	-	2356	1 : 509	1 : 637	400-600 m
9	Khandwa	1.45	N A	584	-	584	1 : 248	N A	200 m
10	Kozhikode	4.20	745	460	-	460	1 : 913	1 : 1619	1.12 km
11	Madurai	9.40		2041	-	2041	1 : 461	1 : 258	
12	Mysore	6.53	872	990	-	990	1 : 660	1 : 880	N A
13	Singroli	1.20	60	42	-	42	1 : 2000	1 : 1428	500 m
14	Ujjain	3.63	312	610	-	610	1 : 595	1 : 511	50,000 sft
15	Trivandrum	5.24	538	445	225	670	1 : 782	1 : 1208	1.2 km
16	Varanasi	9.29	1170	1600	-	1600	1 : 5801	1 : 731	200 m
	Municipalities								
17	Allapuzha	1.69	307	126	-	126	1 : 1341	1 : 2436	1 km
18	Gadag-Betegeri	1.34	98	90	-	90	1 : 1488	1 : 1088	1 km
19	Kollam	1.39	234	63	-	63	1 : 2206	1 : 3714	2 km
20	Tirupur	2.35	202	262	-	262	1 : 896	1 : 770	N A
22	Vellore	1.75	102	74	55	129	1 : 1356	1 : 794	100 m

Ref: P U Asnani, unpublished, data from 1995 to 1998

(i) TYPES OF WASTE TO BE PUT IN THE BIN MEANT FOR FOOD WASTE & BIO-DEGRADABLE WASTE

Food waste of all kinds, cooked and uncooked, including eggshells and bones

Flower and fruit waste including juice peels and house-plant waste

House sweepings (not garden sweepings or yard waste: dispose on-site)

Sanitary towels

Disposable diapers and incontinence pads

Ashes

(ii) TYPES OF RECYCLABLE WASTES TO BE KEPT FOR COLLECTION BY INFORMAL SECTOR

Paper and plastic, all kinds

Cardboard and cartons

Containers of all kinds excluding those containing hazardous material

Packaging of all kinds

Glass of all kinds

Metals of all kinds

Rags, rubber, wood

Foils, wrappings, pouches, sachets and tetrapacks (rinsed)

Cassettes, computer diskettes, printer cartridges and electronic parts

Discarded clothing, furniture and equipment

LIST OF SOME DOMESTIC HAZARDOUS WASTES

Aerosol cans

Batteries from flashlights and button cells

Bleaches and household kitchen and drain cleaning agents

Car batteries, oil filters and car care products and consumables

Chemicals and solvents and their empty containers

Cosmetic items, chemical-based

Injection needles and syringes after destroying them both

Insecticides and their empty containers

Light bulbs, tube-lights and compact fluorescent lamps (CFL)

Medicines, discarded

Paints, oils, lubricants, glues, thinners, and their empty containers

Pesticides and herbicides and their empty containers

Photographic chemicals

Styrofoam and soft foam packaging from new equipment

Thermometers and mercury-containing products

DECENTRALISED COMPOSTING

This should be actively supported by ULBs wherever and whenever possible, as it substantially eliminates the huge cost of secondary transport of waste from its source to a distant centralised processing site and also reduces vehicular pollution. It is ideal for smaller and less crowded cities. But large cities can also adopt decentralised composting where people are willing to support this in available spaces.

Home or Backyard composting

Wet waste (approx. ½ kg per family per day) can be easily composted in a large clay pot or in a tiny corner of the yard or garden, watered daily with a glass of water. Each day's wet garbage sinks lower and decomposes as new layers are added. ULBs can encourage vermi-compost technology in areas where people are willing to do backyard composting.

Apartment and colony composting

Groups of houses or a multi-storey building can also do vermi-composting by identifying a small area on the terrace, along a wall or in one corner of its surrounding open area (in an open brickwork enclosure) for composting wet waste collected from all residents.

Neighbourhood composting

Segregated wet waste collected door-to-door in one lane, street, block or even ward, can be vermi-composted in a corner of a local civic amenity area or park or open site. Municipalities can help by granting rapid permission for use of space by such community efforts.

Garden, park and institutional composting

All biodegradable wastes generated in parks and gardens can be immediately composted on site and used as site soil conditioner or sold. Dry leaves collected during sweeping streets should also be composted in the nearest open spaces. Addition of water and cow dung or animal wastes or some kitchen waste speeds up the process.

Decentralised vermi-composting

Segregated wet waste, preferably vegetable/ fruit market waste, after a week of accelerated aerobic (above-ground) decomposition, can be fed to earthworms, whose excreted vermi-castings are fine-grained and full of useful microbes for plant growth.

A simple technology is being used for the treatment of 15 to 20 tonnes of wastes from Pimpri Chinchwad Municipal Corporation by a private entrepreneur as under:

A thin 150 mm layer of fresh garbage is manually spread daily on the ground below trees or shrubs or crops, over a prior layer of old vermi-compost containing earthworm eggs and several kinds of decomposing bacteria and fungi. This aerobic layer needs to be kept moist by water-sprinklers. No paved yard is required or desirable, as the plant roots take up all of the small quantity of leachate if any, and thrive wonderfully on it.

AEROBIC MICROBIAL COMPOSTING

Biodegradable "wet" food waste (cooked or uncooked) consists mainly of cellulose, which can be broken down by cellulose-digesting microbes into a soil-like substance with manurial values, called compost, if provided the right temperature and moisture and enough oxygen to multiply.

This is best done at a minimum scale of one tractor-load or truck-load of waste, so that suitable high temperatures can be reached within the centre of the heap which will kill germs, weed seeds and worm eggs. A load of waste is unloaded on the ground and sprayed with water. This heap is then pushed by blade-tractor or front-end loader into a higher heap, sprayed again, and heaped again (and again) to a heap of minimum 4 ft height (and maximum 10 ft height). Spraying should achieve a moisture content of about 40%, moist but not wet or waterlogged, so that air can enter the heap. To accelerate the process of composting some private entrepreneurs spray a dilute solution in water of cow-dung or compost-starting bio-culture (initially 2 kg per tonnes of waste and later 1 kg per tonne of waste).

In 4-10 days, the temperature within the heap will rise to 65-70 degrees C, too hot to put a hand inside for long. Hot air can be seen rising from the heap. Then it is time not to let it overheat or dry out and start burning.

Turn the heap with tractor-blade or front-end loader, so that the outer (cool) layer goes to the centre of the new high heap and the hot inner material covers it. Then spray as before. By this time the volume of the heap is reduced to two-thirds, as water-vapour escapes and some carbon turns to carbon dioxide. After another 7-15 days, when temperatures rise, repeat the process to form a third heap (with 50% of original volume) and later a fourth heap of stabilised ready compost (with 33% of original volume) which will not decompose, generate any more heat or shrink further and can safely be applied to soil without fear of spreading disease or germs.

Larger quantities should be handled not in individual truckload heaps, but a long continuous over-lapping heap of successive days' waste, called a windrow. Repeated turning of up to 700 tons a day of compost at one point (though 300-tons-per-day plants are best) makes sure that anaerobic (airless) conditions do not occur, as this causes smell and discharge of foul polluting liquid (leachate) from the bottom of the rotting heap, and releases methane, a greenhouse-gas, into the atmosphere. Aerobic composting does not generate any leachate from within the heap. During the monsoons, uncovered heaps do generate leachate from rainwater running through them and out at the bottom.

For this reason, it is advisable and necessary to carry out the composting on slightly raised or sloping ground with an impervious surface (concrete or soil-plus-10 to 15% bentonite) which can withstand the movement of turning equipment and of trucks unloading fresh daily waste during the rains.

Such paved compost-yards are expensive, so one must plan the composting operations to use the minimum space. As an example, one can form a long windrow containing two weeks of Monday-to-Sunday wastes. Parallel to it, with space for a waste-turning tractor or front-end-loader to move, a shorter wind-row of turned wastes from the first wind-row can be created, and beyond that again, shorter and shorter rows of twice-or-thrice-turned waste/ compost heaps. As each Monday-to-Sunday heap of windrowed waste is removed by turning, its vacant space is taken by heaped windrows of another week of fresh waste. To save space, these windrows can be in semi-circles instead of parallel heaps, with the fresh waste on the largest outside windrow and thrice-turned compost on the smallest innermost semi-circular heap.

If only biodegradable waste is composted, nothing further need be done before use in agriculture or afforestation. But even with the best segregation, there may be road-dust or some non-biodegradable plastic bags or pouches or glass in the "wet" waste. This needs to be screened out to produce a saleable product. Compost from 10-20 tons of daily waste can be screened manually or with simple mechanical sieves. Larger quantities require more sophisticated equipment, like continuous cylindrical screens of differing sizes, a blower to remove light plastics, a de-stoner to remove heavy particles, and optionally some blending equipment to add additional farmer-friendly microbes to the final compost, if these are not supplied in separate packets with each bag or tractor-load of ready compost.

One-third of the cost of a composting operation is for the paved compost-yard and for the turning vehicles. Another one-third is for the sophisticated plant described above. The better the source-separation of biodegradable waste, the lower this cost can be. The final third is required for infrastructure like fencing; buildings to house equipment and store finished compost, internal roads and weighbridge, offices, power and water etc. (Note: no bore-wells should be drilled on-site as this will lower the local water table and allow deeper entry of any leachate). Every hundred tons-per-day of raw waste received for conversion to compost requires about 2 hectares of land for the compost-yard, 100 liters water per ton of waste, and an investment of about Rs 50-80 lakh. Sieving-plant capacities have to be larger than required daily, as windrow composting can be done even during rains but sieving of wet material is not possible. So the equipment has to be able to sieve 365 days' compost in about 250 working days a year.

Working capital needs are very high, for stock-piled finished material, as farmers usually lift the compost only once or twice a year, all in a period of 2-4 weeks. Hence steady year-round marketing is really the hardest part of any composting operation, world-wide, and therefore best left to private parties and not attempted directly by ULBs. Quality control, so important to farmers, is also best ensured by the private sector with a financial stake in the venture, which usually has a pay back period of 6-7 years. Therefore long lease of 15 or more years at one location on a nominal lease rent and free delivery of garbage at the plant site is necessary to make the project attractive. The local body should negotiate suitable terms with the entrepreneur and share some profits in the form of royalty. Here ULBs have an important role to play in ensuring the quality of compost free of heavy metals, by excluding toxic materials like house-hold batteries or cans of lead-based paint, and industrial wastes like electro-plating sludge, from the waste stream at the source itself.

A few photographs showing mechanised composting process are shown below:



Photo No. 45: Garbage heap being sprayed at the initial stage of composting



Photo No. 46 : Garbage heap being turned with a front-end loader



Photo No. 47: Garbage turned into compost

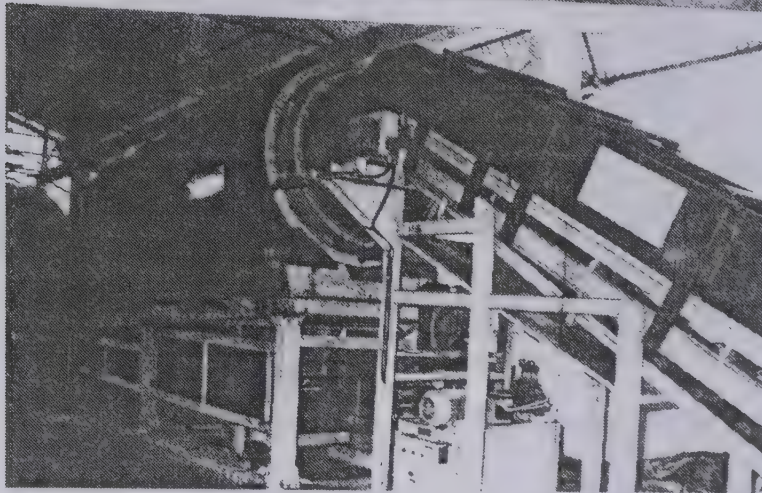
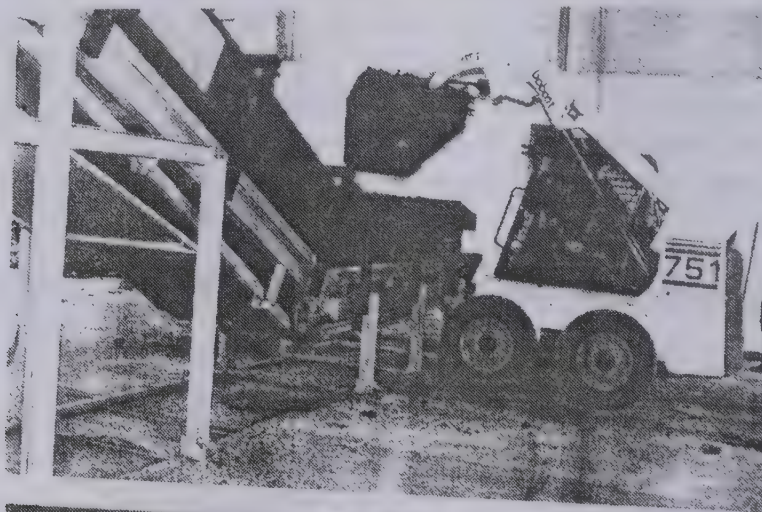


Photo No. 48 & 49 : Composted garbage being taken to mechanical plant for sieving, segregation of recyclables and removal of other unwanted materials



Photo No. 50 : End product (Bio-organic manure) packed for marketing

PROCESS OF VERMI-COMPOSTING

This is a process by which decayed organic matter is eaten by a mix of bacteria, fungi and bacteria inside the bodies of earthworms, to convert waste to a digested soil-like excretion of vermi-castings full of microbes useful to farmers. Earthworms are not pests like caterpillars and do not eat fresh food wastes. There are two stages to vermi-composting: initial decomposition of the waste and only later its conversion by earthworms.

Vermi-composting can be done at any scale from household composting of food-waste in a large slotted plastic bin outside the kitchen window, to city scale vermi-composting. Household level vermi-composting can easily be done on just 0.2 sq. metres for a family of five, whereas large scale vermi-composting requires 2.5 to 3 hectares of land for 100 tons per day of garbage to be treated. Here unlike microbial composting, mixed waste cannot be used for vermi-composting, as toxic substances can kill the earthworms. Only segregated biodegradable food waste can be composted through the process.

Vermi-composting of larger quantities of waste can be done as under

Incoming bio-degradable waste preferably collected from the markets, and domestic food waste collected from house to house, is first heaped at the compost yard in wind-rows. To expedite the process of decomposition of waste, private entrepreneurs prefer de-fouling and degrading bio-cultures. The heap of waste is turned weekly for aeration and allowed to cool. A moisture level of 50 to 55% is maintained, and temperature in a range of 28° to 32° centigrade. The garbage heap attains this temperature in about 2-3 weeks' time, when it is transferred to the vermi-composting pits or shed for further processing.

Vermi-pits are generally made having a depth of about 2 feet, width of 5 to 6 feet and can have any suitable length. Alternatively such waste can be kept in large sheds, 8 metres wide, in conical heaps, having ground level diameter of 5 to 6 feet and height of 3.5 to 4 feet. In each heap 2 truck-loads of waste is generally kept. After making such heaps and ensuring that temperature levels are maintained between 28° to 32° C, chosen varieties of earthworms are introduced. The heaps of waste are probed by light turning after 2 to 3 days of introduction of earthworms, for aeration and to see the movement of the earthworms. Thereafter, no turning is essential.

The earthworms feed on the organic waste and vermi-castings start getting deposited on the surface of the heap. The harvesting of vermi-castings starts from the 40th day from receipt of garbage and 28th day from the introduction of the earthworms. The harvesting continues for about 15 days, by which time most of the composted garbage gets converted to vermi-castings, which are collected and sieved by using simple sieves.

The waste which is left behind un-consumed by earthworms is allowed to remain in the vermi-pits at the same place and fresh waste is added as per the cycle. Over a period of time the portion of waste which did not get composted in the first round gets composted in subsequent rounds along with other waste.

The end product looks like fine granular soil and it has good acceptability in the market.

ULBs have to ensure that market waste or domestic food waste, free from heavy metals and toxic substances or pesticides, is delivered for vermi-composting at the plant site. The toxic substances or pesticides can poison the worms and seriously affect the operation.

It is desirable to set up such decentralised vermi-composting plants through public/NGO participation and centralised units through private sector participation, rather than running the plant departmentally.

The cost of production is estimated to be Rs. 1300 per M. T. at the plant site. If a proper marketing mechanism is arranged, the operation can become commercially viable subject to the condition that the land should be made available to the entrepreneurs at nominal cost and garbage should be delivered free at the plant site. Local bodies could negotiate with entrepreneurs the amount of royalty that they could pay to the local bodies for the compost finally produced at the plant site.

